JOURNAL

AND

PROCEEDINGS

OF THE

ROYAL SOC

OF

NEW SOUTH WAL

FOR

1883.

INCORPORATED 1881.

VOL. XVII.

EDITED BY

A. LIVERSIDGE, F.R.S.

Professor of Chemistry and Mineralogy in the Uni

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NOTICE.

The Smithsonian Institution, Washington, U.S.A., and Messrs. Trübner & Co., 57, Ludgate Hill, London, have kindly undertaken to receive and forward parcels of books and printed matter intended for the Society.

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ROYAL SOCIETY OF NEW SOUTH WALES.

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VOLUME XVII.

NOTICE.

The Royal Society of New South Wales originated in 1821 as the "Philosophical Society of Australasia"; after an interval of inactivity, it was resuscitated in 1850, under the name of the "Australian Philosophical Society," by which title it was known until 1856, when the name was changed to the "Philosophical Society of New South Wales"; in 1866, by the sanction of Her Most Gracious Majesty the Queen, it assumed its present title, and was incorporated by Act of the Parliament of New South Wales in 1881.

ROYAL SOCIETY OF NEW SOUTH WALES INCORPORATION.

An Act to incorporate a Society called "The Royal Society of New South Wales." [16 December, 1881.]

WHEREAS a Society called (with the sanction of Her Most Gracious Majesty the Queen) "The Royal Society of New South Wales" has under certain rules and by-laws been formed at Sydney in the Colony of New South Wales for the encouragement of studies and investigations in Science Art Literature and Philosophy And whereas the Council of the said Society is at the present time composed of the following office-bearers and members His Excellency the Right Honorable Lord Augustus Loftus P.C. G.C.B. Honorary President The Honorable John Smith C.M.G. M.D. LL.D. President and Charles Moore Esquire F.L.S. Director of the Botanic Gardens Sydney and Henry Chamberlaine Russell Esquire B.A. (Sydney) F.R.A.S. F.M.S. London Government Astronomer for New South Wales Vice-Presidents and H. G. A. Wright Esquire M.R.C.S. Honorary Treasurer Archibald Liversidge Esquire Associate of the Royal School of Mines London Fellow of the Institute of Chemistry of Great Britain and Ireland and Professor of Geology and Mineralogy in the University of Sydney and Carl Adolph Leibius Esquire Doctor of Philosophy of the University of Heidelberg Fellow of the Institute of Chemistry of Great Britain and Ireland Honorary Secretaries W. A. Dixon Fellow of the Institute of Chemistry of Great Britain and Ireland G. D. Hirst Esquire Robert Hunt Esquire Associate of the Royal School of Mines London Deputy Master Sydney Branch Royal Mint Eliezer L. Montefiore Esquire Christopher Rolleston Esquire C.M.G.. Preamble.

Charles Smith Wilkinson Esquire Government Geologist Members of the Council And whereas it is expedient that the said Society should be incorporated and should be invested with the powers and authorities hereinafter contained Be it therefore enacted by the Queen's Most Excellent Majesty by and with the advice and consent of the Legislative Council and Legislative Assembly of New South Wales in Parliament assembled and by the authority of the same as follows:—

Interpretation clause.

1. For the purposes of this Act the following words in inverted commas shall unless the context otherwise indicate bear the meaning set against them respectively—

"Corporation" the Society hereby incorporated

"Council" the Members of the Council at any duly convened meeting thereof at which a quorum according to the by-laws at the time being shall be present

"Secretary" such person or either one of such persons who shall for the time being be the Secretary or Secretaries honorary or otherwise of the said Society (saving and excepting any Assistant Secretary of the said Society).

Incorporation clause.

2. The Honorary President the President Vice-Presidents Officers and Members of the said Society for the time being and all persons who shall in manner provided by the rules and by-laws for the time being of the said Society become members thereof shall be for the purposes hereinafter mentioned a body corporate by the name or style of "The Royal Society of New South Wales" and by that name shall and may have perpetual succession and a common seal and shall and may enter into contracts and sue and be sued plead and be impleaded answer and be answered unto defend and be defended in all Courts and places whatsoever and may prefer lay and prosecute any indictment information and prosecution against any person whomsoever and any summons or other writ and any notice or other proceeding which it may be requisite to serve upon the Corporation may be served upon the Secretary or one of the Secretaries as the case may be or if there be no Secretary or if the Secretaries or Secretary be absent from the Colony then upon the President or either of the Vice-Presidents.

Rules and By-laws.

3. The present rules and by-laws of the said Society shall be deemed and considered to be and shall be the rules and by-laws of the said Corporation save and except in so far as any of them are or shall or may be altered varied or repealed under the powers for that purpose therein contained or are

The Royal Society of New South Wales.

OFFICERS FOR 1883-84.

HONORARY PRESIDENT:

HIS EXCELLENCY THE RT. HON. LORD AUGUSTUS LOFTUS, G.C.B., &c., &c., &c.

PRESIDENT:

HON. PROFESSOR SMITH, C.M.G., M.D., M.L.C.

VICE-PRESIDENTS:

CHARLES MOORE, F.L.S.
W. A. DIXON, F.C.S.

HONORARY TREASURER:

H. G. A. WRIGHT, M.R.C.S., E.

HONORARY SECRETARIES:

PROFESSOR LIVERSIDGE, F.R.S., F.C.S., &c.
DR. ADOLPH LEIBIUS, M.A., F.C.S.

COUNCIL:

HUNT, ROBERT, F.G.S., &c.
MORRIS, DR. W.
POOLMAN, F.
PEDLEY, P. R.
ROLLESTON, CHR., C.M.G.
RUSSELL, H. C., B.A., F.R.A.S.

ASSISTANT SECRETARY:

W. H. WEBB.

INDEX TO RULES.

or may be inconsistent or incompatible with or repugnant to any of the provisions of this Act or any of the laws now or hereafter to be in force in the said Colony.

4. The Corporation shall have power to purchase acquire and hold lands and any interest therein and also to sell and dispose of the said lands or any interest therein and all lands tenements hereditaments and other property of whatever nature now belonging to the said Society under the said rules and by-laws or vested in Trustees for them shall on the passing of this Act be vested in and become the property of the said Corporation subject to all charges claims and demands in anywise affecting the same. **Power to acquire and hold and to sell lands &c.**

5. The ordinary business of the Corporation in reference to its property shall be managed by the Council and it shall not be lawful for individual members to interfere in any way in the management of the affairs of the Corporation except as by the rules and by-laws for the time being shall be specially provided. **Ordinary business to be managed by the Council.**

6. The Council shall have the general management and superintendence of the affairs of the Corporation and excepting the appointment of President and Vice-Presidents and other honorary officers who shall be appointed as the by-laws of the Society shall from time to time provide the Council shall have the appointment of all officers and servants required for carrying out the purposes of the Society and of preserving its property and it may also define the duties and fix the salaries of all officers Provided that if a vacancy shall occur in the Council during any current year of the Society's proceedings it shall be lawful for the Council to elect a member of the Society to fill such vacancy for the unexpired portion of the then current year The Council may also purchase or rent land houses or offices and erect buildings or other structures for any of the purposes for which the Society is hereby incorporated and may borrow money for the purposes of the Corporation on mortgages of the real and chattel property of the Corporation or any part thereof or may borrow money without security provided that the amount so borrowed without security shall never exceed in the aggregate the amount of the income of the Corporation for the last preceding year and the Council may also settle and agree to the covenants powers and authorities to be contained in the securities aforesaid. **Powers of Council.**

7. In the event of the funds and property of the Corporation being insufficient to meet its engagements each member thereof shall in addition to his subscription for the **Liability members.**

then current year be liable to contribute a sum equal thereto towards the payment of such engagements but shall not be otherwise individually liable for the same and no member who shall have commuted his annual subscription shall be so liable for any amount beyond that of one year's subscription.

Custody of common seal.

8. The Council shall have the custody of the common seal of the Corporation and have power to use the same in the affairs and business of the Corporation and for the execution of any of the securities aforesaid and may under such seal authorize any person without such seal to execute any deed or deeds and do such other matter as may be required to be done on behalf of the Corporation but it shall not be necessary to use the said seal in respect of the ordinary business of the Corporation nor for the appointment of their Secretaries Solicitor or other officers.

Certified copy of rules and by-laws to be evidence.

9. The production of a printed or written copy of the rules and by-laws of the Corporation certified in writing by the Secretary or one of the Secretaries as the case may be to be a true copy and having the common seal of the Corporation affixed thereto shall be conclusive evidence in all Courts of such rules and by-laws and of the same having been made under the authority of this Act.

Elections not made in due time may be made subsequently.

10. In case any of the elections directed by the rules and by-laws for the time being of the Corporation to be made shall not be made at the times required it shall nevertheless be competent to the Council or to the members as the case may be to make such elections respectively at any ordinary meeting of the Council or at any annual or special general meeting held subsequently.

Secretary may represent Corporation for certain purposes.

11. The Secretary or either one of the Secretaries may represent the Corporation in all legal and equitable proceedings and may for and on behalf of the Corporation make such affidavits and do such acts and sign such documents as are or may be required to be done by the plaintiff or complainant or defendant respectively in any proceedings to which the Corporation may be parties.

RULES.

(*Revised October 1st*, 1879.)

Object of the Society.

I. The object of the Society is to receive at its stated meetings original papers on Science, Art, Literature, and Philosophy, and especially on such subjects as tend to develop the resources of Australia, and to illustrate its Natural History and Productions.

Honorary President.

II. The Governor of New South Wales shall be *ex officio* Honorary President of the Society.

Other Officers.

III. The other Officers of the Society shall consist of a President, who shall hold office for one year only, but shall be eligible for re-election after the lapse of one year; two Vice-Presidents, a Treasurer, and one or more Secretaries, who, with six other Members, shall constitute a Council for the management of the affairs of the Society.

Election of Officers and Council.

IV. The President, Vice-Presidents, Secretaries, Treasurer, and the six other Members of Council, shall be elected annually by ballot at the General Meeting in the month of May.

V. It shall be the duty of the Council each year to prepare a list containing the names of members whom they recommend for election to the respective offices of President, Vice-Presidents, Hon. Secretaries and Hon. Treasurer, together with the names of six other members whom they recommend for election as ordinary members of Council.

The names thus recommended shall be proposed at one meeting of the Council, and agreed to at a subsequent meeting.

Such list shall be suspended in the Society's Rooms, and a copy shall be sent to each ordinary member not less than fourteen days before the day appointed for the Annual General Meeting.

VI. Each member present at the Annual General Meeting shall have the power to alter the list of names recommended by the Council, by adding to it the names of any eligible members not already included in it and removing from it an equivalent number of names, and he shall use this list with or without such alterations as a balloting list at the election of Officers and Council.

The name of each member voting shall be entered into a book, kept for that purpose, by two Scrutineers elected by the members present.

No ballot for the election of Members of Council, or of New Members, shall be valid unless twenty members at least shall record their votes.

Vacancies in the Council during the year.

VII. Any vacancies occurring in the Council of Management during the year may be filled up by the Council.

Candidates for admission.

VIII. Candidates must be at least twenty-one years of age.

Every candidate for admission as an ordinary member of the Society shall be recommended according to a prescribed form of certificate by not less than three members, to two of whom the candidate must be personally known.

Such certificate must set forth the names, place of residence, and qualifications of the candidate.

The certificate shall be read at the three Ordinary General Meetings of the Society next ensuing after its receipt, and during the intervals between those three meetings, it shall be suspended in a conspicuous place in one of the rooms of the Society.

The vote as to admission shall take place by ballot, at the Ordinary General Meeting at which the certificate is appointed to be read the third time, and immediately after such reading.

At the ballot the assent of at least four-fifths of the members voting shall be requisite for the admission of the candidate.

Entrance Fee and Subscriptions.

IX. The entrance money paid by members on their admission shall be Two Guineas; and the annual subscription shall be Two Guineas, payable in advance; but members elected prior to December, 1879, shall be required to pay an annual subscription of One Guinea only as heretofore.

The amount of ten annual payments may be paid at any time as a life composition for the ordinary annual payment.

New Members to be informed of their election.

X. Every new member shall receive due notification of his election, and be supplied with a copy of the obligation (No. 3 in Appendix), together with a copy of the Rules of the Society, a list of members, and a card of the dates of meeting.

Members shall sign Rules—Formal admission.

XI. Every member who has complied with the preceding Rules shall at the first Ordinary General Meeting at which he shall be present sign a duplicate of the aforesaid obligation in a book to be kept for that purpose, after which he shall be presented by some member to the Chairman, who, addressing him by name, shall say:—"In the name of the Royal Society of New South Wales I admit you a member thereof."

Annual subscriptions, when due.

XII. Annual subscriptions shall become due on the 1st of May for the year then commencing. The entrance fee and first year's subscription of a new member shall become due on the day of his election.

Members whose subscriptions are unpaid not to enjoy privileges.

XIII. An elected member shall not be entitled to attend the meetings or to enjoy any privilege of the Society, nor shall his name be printed in the list of the Society, until he shall have paid his admission fee and first annual subscription, and have returned to the Secretaries the obligation signed by himself.

Subscriptions in arrears.

XIV. Members who have not paid their subscriptions for the current year, on or before the 31st of May, shall be informed of the fact by the Hon. Treasurer.

No member shall be entitled to vote or hold office while his subscription for the previous year remains unpaid.

The name of any member who shall be two years in arrears with his subscriptions shall be erased from the list of members, but such member may be re-admitted on giving a satisfactory explanation to the Council, and on payment of arrears.

At the meeting held in July, and at all subsequent meetings for the year, a list of the names of all those members who are in arrears with their annual subscriptions shall be suspended in the Rooms of the Society. Members shall in such cases be informed that their names have been thus posted.

Resignation of Members.

XV. Members who wish to resign their membership of the Society are requested to give notice in writing to the Honorary Secretaries, and are required to return all books or other property belonging to the Society.

Expulsion of Members.

XVI. A majority of members present at any ordinary meeting shall have power to expel an obnoxious member from the Society, provided that a resolution to that effect has been moved and seconded at the previous ordinary meeting, and that due notice of the same has been sent in writing to the member in question, within a week after the meeting at which such resolution has been brought forward.

Honorary Members.

XVII. The Honorary Members of the Society shall be persons who have been eminent benefactors to this or some other of the Australian Colonies, and distinguished patrons and promoters of the objects of the Society. Every person proposed as an Honorary Member must be recommended by the Council and elected by the Society. Honorary Members shall be exempted from payment of fees and contributions: they may attend the meetings of the Society, and they shall be furnished with copies of the publications of the Society, but they shall have no right to hold office, to vote, or otherwise interfere in the business of the Society.

The number of Honorary Members shall not at any one time exceed twenty, and not more than two Honorary Members shall be elected in any one year.

Corresponding Members.

XVIII. Corresponding Members shall be persons, not resident in New South Wales, of eminent scientific attainments, who may have furnished papers or otherwise promoted the objects of the Society.

Corresponding Members shall be recommended by the Council, and be balloted for in the same manner as ordinary Members.

Corresponding Members shall possess the same privileges only as Honorary Members.

The number of Corresponding Members shall not exceed twenty-five, and not more than three shall be elected in any one year.

Ordinary General Meetings.

XIX. An Ordinary General Meeting of the Royal Society, to be convened by public advertisement, shall take place at 8 p.m., on the first Wednesday in every month, during the last eight months of the year; subject to alteration by the Council with due notice.

Order of Business.

XX. At the Ordinary General Meetings the business shall be transacted in the following order, unless the Chairman specially decide otherwise:—

1—Minutes of the preceding Meeting.
2—New Members to enrol their names and be introduced.
3—Ballot for the election of new Members.
4—Candidates for membership to be proposed.
5—Business arising out of Minutes.
6—Communications from the Council.
7—Communications from the Sections.
8—Donations to be laid on the Table and acknowledged.
9—Correspondence to be read.
10—Motions from last Meeting.
11—Notices of Motion for the next Meeting to be given in.
12—Papers to be read.
13—Discussion.
14—Notice of Papers for the next Meeting.

Annual General Meeting.—Annual Reports.

XXI. A General Meeting of the Society shall be held annually in May, to receive a Report from the Council on the state of the Society, and to elect Officers for the ensuing year. The Treasurer shall also at this meeting present the annual financial statement.

Admission of Visitors.

XXII. Every ordinary member shall have the privilege of introducing two friends as visitors to an Ordinary General Meeting of the Society or its Sections, on the following conditions:—

1. That the name and residence of the visitors, together with the name of the member introducing them, be entered in a book at the time.
2. That they shall not have attended two consecutive meetings of the Society or of any of its Sections in the current year.

The Council shall have power to introduce visitors irrespective of the above restrictions.

Council Meetings.

XXIII. Meetings of the Council of Management shall take place on the last Wednesday in every month, and on such other days as the Council may determine.

Absence from Meetings of Council.—Quorum.

XXIV. Any member of the Council absenting himself from three consecutive meetings of the Council, without giving a satisfactory explanation in writing, shall be considered to have vacated his office. No business shall be transacted at any meeting of the Council unless three members at least are present.

Duties of Secretaries.

XXV. The Honorary Secretaries shall perform, or shall cause the Assistant Secretary to perform, the following duties :—

1. Conduct the correspondence of the Society and Council.
2. Attend the General Meetings of the Society and the meetings of the Council, to take minutes of the proceedings of such meetings, and at the commencement of such to read aloud the minutes of the preceding meeting.
3. At the Ordinary Meetings of the members, to announce the presents made to the Society since their last meeting ; to read the certificates of candidates for admission to the Society, and such original papers communicated to the Society as are not read by their respective authors, and the letters addressed to it.
4. To make abstracts of the papers read at the Ordinary General Meetings, to be inserted in the Minutes and printed in the Proceedings.
5. To edit the Transactions of the Society, and to superintend the making of an Index for the same.
6. To be responsible for the arrangement and safe custody of the books, maps, plans, specimens, and other property of the Society.

7. To make an entry of all books, maps, plans, pamphlets, &c., in the Library Catalogue, and of all presentations to the Society in the Donation Book.
8. To keep an account of the issue and return of books, &c., borrowed by members of the Society, and to see that the borrower, in every case, signs for the same in the Library Book.
9. To address to every person elected into the Society a printed copy of the Forms Nos. 2 and 3 (in the Appendix), together with a list of the members, a copy of the Rules, and a card of the dates of meeting; and to acknowledge all donations made to the Society, by Form No. 6.
10. To cause due notice to be given of all Meetings of the Society and Council.
11. To be in attendance at 4 p.m. on the afternoon of Wednesday in each week during the session.
12. To keep a list of the attendances of the members of the Council at the Council Meetings and at the ordinary General Meetings, in order that the same may be laid before the Society at the Annual General Meeting held in the month of May.

The Honorary Secretaries shall, by mutual agreement, divide the performance of the duties above enumerated.

The Honorary Secretaries shall, by virtue of their office, be members of all Committees appointed by the Council.

Contributions to the Society.

XXVI. Contributions to the Society, of whatever character, must be sent to one of the Secretaries, to be laid before the Council of Management. It will be the duty of the Council to arrange for promulgation and discussion at an Ordinary Meeting such communications as are suitable for that purpose, as well as to dispose of the whole in the manner best adapted to promote the objects of the Society.

Management of Funds.

XXVII. The funds of the Society shall be lodged at a Bank named by the Council of Management. Claims against the Society, when approved by the Council, shall be paid by the Treasurer.

All cheques shall be countersigned by a member of the Council.

Money Grants.

XXVIII. Grants of money in aid of scientific purposes from the funds of the Society—to Sections or to members—shall expire on the 1st of November in each year. Such grants, if not expended, may be re-voted.

XXIX. Such grants of money to Committees and individual members shall not be used to defray any personal expenses which a member may incur.

Audit of Accounts.

XXX. Two Auditors shall be appointed annually, at an Ordinary Meeting, to audit the Treasurer's Accounts. The accounts as audited to be laid before the Annual Meeting in May.

Property of the Society to be vested in the President, &c.

XXXI. All property whatever belonging to the Society shall be vested in the President, Vice-Presidents, Hon. Treasurer, and Hon. Secretaries for the time being, in trust for the use of the Society; but the Council shall have control over the disbursements of the funds and the management of the property of the Society.

SECTIONS.

XXXII. To allow those members of the Society who devote attention to particular branches of science fuller opportunities and facilities of meeting and working together with fewer formal

restrictions than are necessary at the general Monthly Meetings of the Society,—Sections or Committees may be established in the following branches of science:—

Section A.—Astronomy, Meteorology, Physics, Mathematics, and Mechanics.

Section B.—Chemistry and Mineralogy, and their application to the Arts and Agriculture.

Section C.—Geology and Palæontology.

Section D.—Biology, *i.e.*, Botany and Zoology, including Entomology

Section E.—Microscopical Science.

Section F.—Geography and Ethnology.

Section G.—Literature and the Fine Arts, including Architecture.

Section H.—Medical.

Section I.—Sanitary and Social Science and Statistics.

Section Committees—Card of Meetings.

XXXIII. The first meeting of each Section shall be appointed by the Council. At that meeting the members shall elect their own Chairman, Secretary, and a Committee of four; and arrange the days and hours of their future meetings. A card showing the dates of each meeting for the current year shall be printed for distribution amongst the members of the Society.

Membership of Sections.

XXXIV. Only members of the Society shall have the privilege of joining any of the Sections.

Reports from Sections.

XXXV. There shall be for each Section a Chairman to preside at the meetings, and a Secretary to keep minutes of the proceedings, who shall jointly prepare and forward to the Hon. Secretaries of the Society, on or before the 7th of December in each year, a report of the proceedings of the Section during that year, in order that the same may be transmitted to the Council.

Reports.

XXXVI. It shall be the duty of the President, Vice-Presidents, and Honorary Secretaries to annually examine into and report to the Council upon the state of—

1. The Society's house and effects.
2. The keeping of the official books and correspondence.
3. The library, including maps and drawings.
4. The Society's cabinets and collections.

Cabinets and Collections.

XXXVII. The keepers of the Society's cabinets and collections shall give a list of the contents, and report upon the condition of the same to the Council annually.

Documents.

XXXVIII. The Honorary Secretaries and Honorary Treasurer shall see that all documents relating to the Society's property, the obligations given by members, the policies of insurance, and other securities shall be lodged in the Society's iron chest, the contents of which shall be inspected by the Council once in every year; a list of such contents shall be kept, and such list shall be signed by the President or one of the Vice-Presidents at the annual inspection.

Branch Societies.

XXXIX. The Society shall have power to form Branch Societies in other parts of the Colony.

Library.

XL. The members of the Society shall have access to, and shall be entitled to borrow books from the Library, under such regulations as the Council may think necessary.

Alteration of Rules.

XLI. No alteration of, or addition to, the Rules of the Society shall be made unless carried at two successive General Meetings, at each of which, twenty-five members at least must be present.

THE LIBRARY.

1. The Library shall be open for consultation and for the issue and return of books daily (except Saturday), between 1·30 and 6 p.m., and on Saturdays from 9 a.m. to 1·30 p.m.; also, on the evenings of Monday, Wednesday, and Friday, from 7 to 10 p.m.

2. No book shall be issued without being signed for in the Library Book.

3. Members are not allowed to have more than two volumes at a time from the Library, without special permission from one of the Honorary Secretaries, nor to retain a book for a longer period than fourteen days; but when a book is returned by a member it may be borrowed by him again, provided it has not been bespoken by any other member. Books which have been bespoken shall circulate in rotation, according to priority of application.

4. Scientific Periodicals and Journals will not be lent until the volumes are completed and bound.

5. Members retaining books longer than the time specified shall be subject to a fine of sixpence per week for each volume.

6. The books which have been issued shall be called in by the Secretaries twice a year; and in the event of any book not being returned on those occasions, the member to whom it was issued shall be answerable for it, and shall be required to defray the cost of replacing the same.

Form No. 1.

ROYAL SOCIETY OF NEW SOUTH WALES.

Certificate of a Candidate for Election.

Name

Qualification or occupation

Address

being desirous of admission into the Royal Society of New South Wales, we, the undersigned members of the Society, propose and recommend him as a proper person to become a member thereof.

Dated this day of 18 .

FROM PERSONAL KNOWLEDGE.	FROM GENERAL KNOWLEDGE.

Signature of candidate

Date received 18 .

N.B.—This certificate must be signed by three or more members, to two of whom the candidate must be personally known. The candidate must be at least twenty-one years of age. This certificate has to be read at three ordinary general meetings of the Society.

Form No. 2.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's House,

Sir, Sydney, 18 .

I have the honour to inform you that you have this day been elected a member of the Royal Society of New South Wales, and I beg to forward to you a copy of the Rules of the Society, a printed copy of an obligation, a list of members, and a card announcing the dates of meeting during the present session.

According to the Regulations of the Society (*vide* Rule No. 9), you are required to pay your admission fee of two guineas, and annual subscription of two guineas for the current year, before admission. You are also requested to sign and return the enclosed form of obligation at your earliest convenience.

I have, &c.,

To Hon. Secretary.

Form No. 3.

ROYAL SOCIETY OF NEW SOUTH WALES.

I, the undersigned, do hereby engage that I will endeavour to promote the interests and welfare of the Royal Society of New South Wales, and to observe its Rules and By-laws, as long as I shall remain a member thereof.

Signed,

Address

Date

Form No. 4.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's House,

Sir, Sydney, 18 .

I have the honour to inform you that your annual subscription of for the current year became due to the Royal Society of New South Wales on the 1st of May last.

It is requested that payment may be made by cheque or Post Office order drawn in favour of the Hon. Treasurer.

I have, &c.,

To Hon. Treasurer.

Form No. 5.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's House,

Sir, Sydney, 18 .

I am desired by the Royal Society of New South Wales to forward to you a copy of its Journal for the year 18 , as a donation to the library of your Society.

I am further requested to mention that the Society will be thankful to receive such of the very valuable publications issued by your Society as it may feel disposed to send.

I have the honour to be,

Sir,

Your most obedient servant,

Hon. Secretary.

Form No. 6.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's House,

Sir, Sydney, 18 .

On behalf of the Royal Society of New South Wales, I beg to acknowledge the receipt of and I am directed to convey to you the best thanks of the Society for your most valuable donation.

I have the honour to be,

Sir,

Your most obedient servant,

Hon. Secretary.

Form No. 7.

Balloting List for the Election of the Officers and Council.

ROYAL SOCIETY OF NEW SOUTH WALES.

Date........................

BALLOTING LIST for the election of the Officers and Council.

Present Council.	Names proposed as Members of the new Council.	
	President.	
	Vice-Presidents.	
	Hon. Treasurer.	
	Hon. Secretaries.	
	Members of Council.	

If you wish to substitute any other name in place of that proposed, erase the printed name in the second column, and write opposite to it, in the third, that which you wish to substitute.

LIST OF THE MEMBERS

OF THE

Royal Society of New South Wales.

P Members who have contributed papers which have been published in the Society's Transactions or Journal; papers published in the Transactions of the Philosophical Society are also included. The numerals indicate the number of such contributions.

† Members of the Council.

‡ Life Members.

Elected.		
1877		Abbott, Joseph Palmer, 6 Wentworth Court, Elizabeth-street.
1877	P 1	Abbott, Thomas Kingsmill, S.M., Central Police Office, Sydney.
1877	P 2	Abbott, W. E., Glengarry, Wingen.
1877		Adams, Francis, A.J.S. Bank, Sydney.
1864		Adams, P. F., Surveyor General, Kirribilli Point, St. Leonards.
1878		Alexander, George M., 48, Margaret-street.
1874		Alger, John, Macquarie-street.
1870		Allen, Sir George Wigram, K.C.M.G., 122, Elizabeth-street North.
1868		Allerding, F., Hunter-street.
1873		Allerding, H. R., Hunter-street.
1856		Allwood, Rev. Canon, B.A. *Cantab.*, "Rorklands," Edgecliff Road, Woollahra.
1881		Amos, Robert, "Renneil," Elizabeth Bay Road.
1877		Anderson, H. C. L., M.A., "Aberfeldie," Summer Hill.
1876		Atchison, Cunningham Archibald, C.E., North Shore.
1873		Atherton, Ebenezer, M.R.C.S. *Eng.*, Macquarie-street.
1882		Atkinson, J. J. O., J. P., Oldbury, Moss Vale.
1873		Austen, Henry, Pitt-street.
1876		Backhouse, Benjamin, 263, George-street.
1878		Backhouse, Alfred P., M.A., "Melita," Elizabeth Bay.
1877		Baker, E. A., Erith Colliery, Bundanoon.
1878		Balfour, James, The Oriental Bank, Pitt-street.
1881		Barff, H. E., M.A., Sydney University.
1876	P 4	Barkas, Wm. James, Lic. R. Col. Phys. *Lond.*, M.R.C.S. *Eng.*, Warialda.
1878		Barker, Francis Lindsay, "Chiltern," Harrow Road, South Kingston.
1879		Barraclough, William, Stephen-street, Balmain.
1875		Bartels, W. C. W., Richmond Terrace.
1876		Bassett, W. F., M.R.C.S., *Eng.*, Bathurst.
1878		Bayley, George W. A., Railway Department, Phillip-street.

Elected.		
1880		Beattie, Josh. A., Lic. K. & Q. Coll. Phys., *Irel.*, Lic. R. Coll. Sur., *Irel.*, Coast Hospital, Little Bay.
1875		Bedford, W. J. G., M.R.C.S. *Eng.*, "Waratah," Newtown, Hobart, Tasmania.
1868		Beilby, E. T., 91, Pitt-street.
1875		Belgrave, Thomas B., M.D. *Edin.*, M.R.C.S. *Eng.*, Market-street
1877		Belfield, Algernon H., "Eversleigh," Armidale.
1875		Belisario, John, M.D., Lyons' Terrace.
1876		Benbow, Clement A., 30, College-street.
1869	P 2	Bensusan, S. L., Exchange, Pitt-street.
1877		Bennett, George F., C.M.Z.S., Toowoomba, Queensland.
1878		Berney, Augustus, H. M. Customs, Sydney.
1878		Bestic, Edwin Henry, L.R.C.S., *Irel.*, L.R.C.P., *Edin.*, Arthursleigh-terrace.
1878		Black, Reginald James, Union Club.
1878		Black, Morrice A., F.I.A., Actuary, Australian Mutual Provident Society, Pitt-street.
1880		Blackmann, C. H. E., 375, George-street.
1877		Bladen, Thomas, 205½, Victoria-street.
1883		Blaxland, Herbert, M.R.C.S.E., L.R.C.P. *Lond.*, Hospital for the Insane, Callan Park, Balmain.
1872		Bolding, H. J., Raymond Terrace, Hunter River.
1879		‡Bond, Albert, Bell's Chambers, Pitt-street.
1874		Bowen, George M. C., "Keston," Kirribilli Point, North Shore.
1876		Brady, Andrew John, Lic. K. & Q. Coll. Phys. *Irel.*, Lic. R. Coll. Sur. *Irel.*, 3, Lyons' Terrace.
1871	P 1	Brazier, John, C.M.Z.S., Corr. M.R.S., Tas., 82, Windmill-street.
1868		Brereton, John Le Gay, M.D. *St. Andrew's*, L.R.C.S. *Edin.*, Domain Terrace.
1879		Brindley, Thomas, Nepean Cottage, Bourke-street, Redfern.
1876		Brodribb, W. A., The Hon., M.L.C, F.R.G.S., 133, Macquariestreet.
1878		‡Brooks, Joseph, F.R.G.S., "Hope Bank," Nelson-st., Woollahra.
1876		Brown, Henry Joseph, Newcastle.
1880		Brown, John Studd, Dubbo.
1876		Brown, Thomas, Eskbank, Bowenfels.
1882		Bullock, Chas. Cyrus, 2, Euroka Terrace, St. Leonards.
1877		Bundock, W. C., "Wyangarie," Casino.
1877		Burnell, Arthur, Survey Office.
1878		Burnett, Robt. H., C.E., Whitehall Club, London, S.W.
1875		Burton, Edmund, Land Titles Office, Elizabeth-street North.
1875		Busby, The Hon. William, M.L.C., "Redleaf," South Head Road, Woollahra.
1880		Bush, Thomas James, Engineer's Office, Gas Works, Sydney.
1876		Cadell, Alfred, Vegetable Creek, New England.
1876		Cadell, Thomas, "Wotonga," East St. Leonards.
1880		Caird, George S., "Lillingstone," Ocean-street, Woollahra.
1876		Campbell, Allan, L.R.C.P., *Glasgow*, Yass.
1876		Campbell, The Hon. Alexander, M.L.C., Woollahra.
1868		Campbell, The Hon. Charles, M.L.C., "Clunes," South Kingston.

c

Elected.		
1879		Cameron, John. Geodetic Surveyor, Trig. Branch, Surveyor-General's Office.
1879		Campbell, Revd. Joseph, M.A., "The Parsonage," Glen Innes.
1870		Cane, Alfred, 110, Victoria-street.
1876		Cape, Alfred J., M.A., *Syd.*, "Karoola," Edgecliff Road.
1882		Carruthers, Chas. Ulic, L.K.Q.C.P., L.R.C.S., *Irel.*, Montague-street, Balmain.
1876		Chandler, Alfred, "Wambiana," Homebush.
1882		Chambers, Thos., F.R.C.P., F.R.C.S. *Edin.*, 1. Lyons' Terrace.
1879	P 1	‡Chard, J. S., District Surveyor, Armidale.
1878		Chatfield, William, Parkhouse, Parramatta.
1878		Chisholm, Edwin, M.R.C.S., E., L.S.A., &c., "Abergeldie," Ashfield.
1877		Clarke, William, care of John Wilson & Co., York-street.
1874		Clay, William French, M.A., *Cantab.*, M.D. *Syd.*, M.R.C.S. *Eng.*, Fellow of St. Paul's College, North Shore.
1876		Codrington, John Fredk., M.R.C.S., E.; Lic. R.C. Phys., L.; Lic. R.C. Phys., *Edin.*, Orange.
1878		Collie, Revd. Robert, F.L.S., "The Manse," Wellington-street, Newtown.
1878		Colquhoun, George, 3, Mona-terrace, Rushcutters' Bay.
1880		Colyer, Henry Cox, M.A., "Clinton," Liverpool-street, Darlinghurst.
1876		Colyer, John Ussher Cox. A.S.N. Company, Sydney.
1856		Comrie, James, "Northfield," Kurrajong Heights.
1876		Conder, Wm., Survey Office, Sydney.
1882		Conlan, George Nugent, care of Mr. C. E. Riddell, Union Club.
1882		Copeland, H. P. R., S.W.S. Camp, Narellan.
1882		Cornwell, Samuel, junr., Kent Brewery, Sydney.
1878		Cottee, Wm. Alfred, 2, Spring-street.
1880		Cox, The Hon. George Henry, M.L.C., "Winbourn," Penrith.
1859	P 1	Cox, James, M.D. *Edin.* C.M.Z.S., F.L.S., 73, Hunter-street.
1865	P 2	Cracknell, E. C., Superintendent of Telegraphs, Telegraph Office, George-street.
1869		Creed, J. Mildred, M.R.C.S. *Eng.*, L.R.C.P., *Edin.*, Woollahra.
1870		Croudace, Thomas, Lambton.
1881		Crummer, Henry, 47, Rialto Terrace, Darlinghurst.
1877		Cunningham, Andrew, "Lanyon," Queanbeyan.
1882		Curran, Rev. John Milne, Dubbo.
1873		Daintrey, Edwin, "Æolia," Randwick.
1876		Dansey, George Frederick, M.R.C.S. *London*, Cleveland-street, Redfern.
1875		Dangar, Frederick H., care of Dangar, Gedye, & Co., Macquarie Place.
1876		Darley, Cecil West, Mount-street, St. Leonards.
1877		Darley, Hon. F. M., M.L.C., B.A., Wentworth Court, Elizabeth-street.
1879		Davenport, Samuel, C.M.G., "Beaumont," Adelaide, South Australia.
1878		Dean, Alexander, J.P., Elizabeth-street.
1877		Deck, John Field, M.D., Ashfield.

Elected.		
1856		Deffell, George H., Chief Commissioner, Insolvency Court, King-street.
1881		Delarue, Leopold H., 378, George-street.
1875		De Salis, The Hon. Leopold Fane, M.L.C., "Cuppercumbalong," Lanyon.
1875		De Salis, L. W., junr., "Strathmore," Bowen, Queensland.
1876		Dight, Arthur, Richmond.
1875	P 9	†Dixon, W. A., F.C.S., Fellow and Member Inst. of Chemistry of Gt. Britain and Irel., Lecturer on Chemistry, The Technical College, School of Arts, Pitt-street, Sydney, *Vice-President.*
1882		Dixon, Fletcher, English, Scottish, and Australian Chartered Bank, George-street.
1880		Dixson, Craig, M.B., C.M., *Edin.*, M.R.C.S., *Eng.*, M.D. *Syd.*, 2, Clarendon Terrace, Elizabeth-street.
1880		Dixson, Thomas, M.B., C.M., *Edin.*, "Ellalong," Ashfield.
1876		Docker, Ernest B., M.A. *Sydn.*, "Carhullen," Parramatta.
1879		Docker, Wilfred L., "Craigstone," William-street South.
1882		Donkin, J. B., The Exchange, Sydney.
1876		Douglas, James, L.R.C.S. *Edin.*, 3, Hope Terrace, Glebe Road.
1879		Dowling, Neville, Wallis-street, Woollahra.
1876		Drake, William Hedley, Fellow of the Inst. of Bankers, Lond., Colonial Bank of New Zealand, Napier, N.Z.
1873		Du Faur, Eccleston, F.R.G.S., "Marfa," Croydon.
1876		Eales, John, Duckenfield Park, Morpeth.
1876		Egan, Myles, M.R.C.S. *Eng.*, 2, Hyde Park Terrace, Liverpool-street.
1874		Eichler, Charles F., M.D. *Heidelberg*, M.R.C.S. *Eng.*, Bridge-street.
1876		Eldred, W. H., 62, Margaret-street.
1881		Elliott, F. W., Elizabeth Bay.
1876		Evans, George, "Como," Darling Point.
1881		Evans, Thomas, M.R.C.S., *E.*, 211, Macquarie-street North.
1881		Ewan, John Frazer, M.B., Mast. Surg. Univ. *Edin.*, Carlton Terrace, Wynyard Square.
1877		Fairfax, Edward R., 177, Macquarie-street.
1868		Fairfax, James R., *Herald* Office, Hunter-street.
1880		Ferguson, J. W., 70, Darlinghurst Road.
1881		Fiaschi, Thos., M.D., M. Ch., Univ. Pisa, Phillip-street, Sydney.
1880		Finlayson, David, Manager, Union Bank, Pitt-street.
1876		Firth, Rev. Frank, Wesleyan Parsonage, Waverley.
1874		Fischer, Carl F., M.D., M.R.C.S., *Eng.*; L.R.C.P., *Lond.*; F.G.S.; F.L.S.; F.R.M.S.; Member Imp. Botanical and Zoological Society, Vienna; Corr. Member Imp. Geographical Society, Vienna; 143, Macquarie-street.
1876		Fitzgerald, R. D., F.L.S., Surveyor-General's Office.

Elected.		
1856		Flavelle, John, 340, George-street.
1880		Forbes, Alexr. Leith, M.A.. Dept. of Public Instruction.
1879		‡Foreman, Joseph, M.R.C.S., L.R.C.P., *Edin.*, 161, Macquarie-street.
1863		Fortescue, G., M.B. *Lond.*, F.R.C.S., F.L.S., Lyons' Terrace.
1881		Foster, W. J., Temple Court, King-street.
1878		Fraser, Robert, 12, Barrack-street.
1882		Fraser, Rev. John G., M.A., Warden of Camden College, Glebe Point.
1883		Fraser, John, B.A., *Edin.*, Délégué Général (pour l'Océanie), de l'Institution Ethnographique de Paris, Associate of the Victoria (Philosophical) Institute of Great Britain, "Sauchie House," West Maitland.
1875		Frazer, Hon. John, M.L.C., York-street.
1878		Fuller, Francis John, Harbours and Rivers Office, Fitzroy Dock.
1881		Furber, T. F., Surveyor-General's Office.
1879		Gabriel, C. Louis, care of Mrs. J. J. Hill, Lambton.
1880		Gardiner, Rev. Andrew, M.A., Glebe Point.
1877		Garnsey, Rev. C. F., Christ Church Parsonage, Sydney.
1868	P 1	Garran, Andrew, LL.D., *Sydney Morning Herald* Office, Hunter-street.
1883		Garrett, H. Edwd., M.R.C.S.E., 37, Wynard Square West.
1877		Garvan, J. P., East St. Leonards.
1878		Gedye, Charles Townsend, "Eastbourne," Darling Point.
1878		George, Hugh, *Sydney Morning Herald* Office.
1876		George, W. R., 360, George-street.
1879		Gerard, Francis, Occupation of Lands Office.
1878		Giblin, Vincent W., Australian Joint Stock Bank, Sydney.
1876		Gilchrist, W. O., "Greenknowes," Potts's Point.
1875		Gilliat, Henry Alfred, Australian Club.
1876	P 2	Gipps, F. B., C.E., "Lindisfern," Cheltenham Road, Burwood.
1878		Goddard, William C., The Exchange, New Pitt-street.
1881		Goergs, Karl W., Riviere College, Woollahra.
1876		Goode, George, M.A., M.D., M. Ch., Trin. Coll., *Dub.*, Enfield House, Camden.
1883		Goode, Wm. Hy., M.A., M.D., Ch.M., Diplomate in State Medicine, *Dub.*, Surgeon Royal Navy, Corres. Mem. Royal Dublin Society, Mem. Brit. Med. Assoc., Lecturer on Medical Jurisprudence, University of Sydney, 159, Macquarie-street North.
1859		Goodlet, John H., George-street.
1876		Grahame, Hon. Wm., M.L.C., Stratheam House, Waverley.
1873		Greaves, W. A. B., "Braylesford," Bondi.
1881		Griffin, T. H. F., Commercial Bank, Richmond.
1878		Griffiths, Frederick C., Macquarie-street.
1877		Griffiths, G. Neville, The Domain, Sydney.
1877		Gurney, T. T., M.A. *Cantab.*, late Fellow of St. John's College, Cambridge, Professor of Mathematics and Natural Philosophy, University of Sydney.

Elected.		
1880		Haege, Hermann, 93, Pitt-street.
1878		Hall, Richard T., care of W. H. Quodling, Esq., Public Works Department.
1880		Halligan, Gerald H., C.E., "Eugowra," Hunter's Hill.
1882		Hammond, Mark J., Ashfield.
1882		Hankins, Geo. Thos., M.R.C.S.E., Liverpool-street, Hyde Park.
1881		Harcus, Lorimer E., Allt-street, Ashfield.
1877		Hargrave, Lawrence, Rushcutter's Bay Road.
1881		Harris, John, "Grenville," Thomas-street, Ultimo.
1877		‡Harrison, L. M., Macquarie Place.
1878	P 2	Hart, Ludovico, Kilcatten Lodge, Millswyn-street, South Yarra, Melbourne.
1877	P 1	Hawkins, H. S., M.A., Balmain.
1874		Hay, The Hon. Sir John, K.C.M.G., M.L.C., A.M. *Aberdeen.* President of the Legislative Council, Rose Bay, Woollahra.
1876		Heaton, J. H., St. Stephens Club, Westminster, London.
1881		Helms, Albert, Ph. D., *Berlin*, Sydney University.
1875		Helsham, Douglass, "Eurimbulah," Port Curtis, Queensland.
1877		Henry, James, 750, George-street.
1878		Herborn, E. W. L., "Flinton," Burwood.
1878		Herborn, Eugene, Licensed Surveyor, Bathurst.
1880		Hern, Charles E., 14, Cambridge Terrace, Hyde Park, London, W.
1876		Heron, Henry, solicitor, 49, Hunter-street.
1878		Hewett, Thomas Edward, The Observatory, Sydney
1879		Higgins, R. G., "Clifford," Potts's Point.
1879		Hills, Robert, Elizabeth Bay.
1879		Hitchins, Edwd. Lytton, "Florence," Victoria-street North Darlinghurst.
1877		Hindson, Lawrence, care of Mr. F. D. Humphrey, M.L.A., Bell's Chambers, Pitt-street.
1876	P 2	Hirst, Geo. D., 377, George-street.
1878		Hodgson, Rev. E. G., M.A. *Oxon.*, S.C.L., Vice-Warden of St. Paul's College, University.
1882		Hoff, August (changed name from Duckershoff) M.D. Univ. *Leipzig*, 197, Liverpool-street.
1868		Holt, The Hon. Thomas, M.L.C., Sutherland House, George's River.
1876		Holroyd, Arther Todd, M.B. *Cantab.*, M.D. *Edin.*, F.L.S., F.Z.S., F.R.G.S., Master-in-Equity, Sherwood Scrubs, Parramatta.
1870		Horton, Rev. Thomas, Ina Terrace, Woollahra.
1879		Houison, Andrew, B.A., M.B.C.M., *Edin.*, 128, Phillip-street.
1877		Hume, J. K., Cooma Cottage, Yass.
1878		†Hunt, Robert, F.G.S., Associate of the Royal School of Mines, London, Deputy Master of the Royal Mint, Sydney.
1882		Hurst, George, M.B., Univ. *Lond.*, Mast. Surg. Univ. *Edin.*, 28, College-street, Hyde Park.
1879		Inglis, James, 28, Charlotte Place.
1880		Iredale, Lancelot, A.F., Goolhi, Gunnedah.

Elected.		
1878		Jackson, Arthur Levett, Government Printing Office.
1876		Jackson, Henry Willan, M.R.C.S. *Eng.*, Lic. R. C. Phys., *Edin.* 146, Phillip-street.
1879		Jarvie, Rev. A. Milne, Univ. Council, *Edin.*, "Manse," Jamison-street.
1879		Jefferis, Rev. James, LL.B., "The Retreat," Newtown.
1879		Johnson, James W., "Brooksby," Double Bay.
1876		Jones, James Aberdeen, Lic. R.C. Phys. *Edin.*, Booth-street Balmain.
1876		Jones, Richard Theophilus, M.D. *Sydn.*, L.R.C.P. *Edin.*, Ashfield.
1867		Jones, P. Sydney, M.D. *Lond.*, F.R.C.S. *Eng.*, College-street.
1877		Jones, Edward Lloyd, 349, George-street, Sydney.
1874		Jones, James, Bathurst-street.
1879		Jones, John Trevor, Burton-street.
1863		Josephson, Joshua Frey, F.G.S., District Court Judge, Enmore Road, Newtown.
1876	P 1	Josephson, J. P., Assoc. Mem. Inst. C.E., 235, Macquarie-street North.
1878		Joubert, Numa, Hunter's Hill.
1883		Kater, H. E., Moss Vale.
1878		Keele, Thos. Wm., Harbours and Rivers Department, Phillip-street.
1877		Keep, John, "Broughton," Leichhardt.
1879		Kemmis, Rev. Thomas, St. Mark's Parsonage, Darling Point.
1874		King, Philip G., "Banksia," William-street, Double Bay.
1877		Kinloch, John, M.A., 21, Wentworth Court, Elizabeth-street.
1878		Knaggs, Saml. J., M.D., Newcastle.
1881		Knibbs, G. H., Mem. Inst. of Surveyors, Trig. Branch, Surveyor-General's Office.
1874		Knox, George, M.A., *Cantab.*, Phillip-street.
1875		Knox, Edward, The Hon., M.L.C., O'Connell-street.
1877		Knox, Edward W., "Lansdowne," Darling Point.
1877		Kopsch, G., Telegraph Department.
1878		Kretschmann, Joseph; care of Mr. Moss, Hunter-street.
1878		Kyngdon, F. B., 221, Darlinghurst Road.
1878		Kyngdon, Fred. H., M.D. *Aberdeen*; L.S.A., *L.*; M.R.C.S., *E.*; C.M., *Aberdeen*, "Altona," North Shore.
1876		Langley, W. E., "The Pines," Berry-street, St. Leonards.
1874	P 1	Latta, G. J., "Hawthorne," Crystal-street, Petersham.
1876		Laure, Louis Thos., M.D. Surg. Univ. *Paris*, 138, Castlereagh-street.
1880		Leask, John L., M.B.C.M. *Edin.*, "Terra Bella," Pyrmont Bridge Road.
1859	P 5	†Leibius, Adolph, Ph.D., Heidelberg, M.A., F.C.S.; Fel. Inst. Chemistry of Gt. Brit. and Irl.; Senior Assayer to the Sydney Branch of the Royal Mint, *Hon. Secretary*.

Elected

1874 | | Lenehan, Henry Alfred, Sydney Observatory.
1883 | | Lingen, J. T., M.A. *Cantab.*, 101, Elizabeth-street.
1883 | | Little, Wm., L.R.C.P., L.R.C.S. *Edin.*, Burwood.
1872 | P 23 | †Liversidge, Archibald, F.R.S.; Assoc. Roy. Sch. Mines, *Lond.*; F.C.S.; Fel. Inst. Chemistry of Gt. Brit. and Irl.; F.G.S.; F.L.S.; F.R.G.S.; Mem. Phy. Soc. London; Mem. Mineralogical Soc. Gt. Brit. and Irel.; Cor. Mem. Roy. Soc. Tas.; Cor. Mem. Senckenberg Institute, Frankfurt; Cor. Mem. Soc. d'Acclimat. Mauritius; Hon. Fel. Roy. Hist. Soc. Lond.; Mem. Min. Soc. of France; Professor of Chemistry and Mineralogy in the University of Sydney, *Hon. Secretary*. The University, Glebe.
1874 | | Lloyd, George Alfred, F.R.G.S., "Scottforth," Elizabeth Bay.
1881 | | Lloyd, Lancelot T., "Eurotah," William-street East.
1879 | | Loftus, His Excellency The Right Hon. Lord Augustus, G.C.B. &c., &c., &c., *Hon. President*.
1876 | | Lord, The Hon. Francis, M.L.C., North Shore.
1877 | | Lord, George Lee, "Bramley," Elizabeth Bay.
1882 | | Lovell, R. Haynes, M.R.C.S., L.R.C.P., *Lond.* 26, Wynward Sq.
1878 | | Low, Hamilton, H.M. Customs.
1880 | | Low, Andrew S., "Merrylands," Granville.
1881 | | Lowe, Edwin, Wilgar Downs Station, *via* Girilambone.

1876 | | M'Culloch, A. H., jun., M.L.A., 121, Pitt-street.
1874 | | M'Cutcheon, John Warner, Assayer to the Sydney Branch of the Royal Mint.
1878 | | MacDonald, Ebenezer, Oriental Bank, Sydney.
1868 | | MacDonnell, William J., F.R.A.S., Bank of New South Wales, Port Macquarie.
1877 | | MacDonnell, Samuel, 312, George-street, Sydney.
1882 | | MacGillivray, P. H., M.A., M.R.C.S., F.L.S., Sandhurst, Victoria.
1876 | | M'Kay, Dr., Church Hill.
1880 | P 1 | M'Kinney, Hugh G., Assoc. Mem. Inst. C.E., "Seaton," Point Piper Road, Paddington.
1876 | | MacLaurin, Henry Norman, M.A., M.D. Univ. *Edin.*, Lic. R. Coll. Sur. *Edin.*, No. 155, Macquarie-street.
1878 | P 1 | ‡MacPherson, Rev. Peter, M.A., 187, Albion-street, Sydney.
1872 | | Mackenzie, John, F.G.S., Examiner of Coal Fields, Newcastle.
1874 | | Mackenzie, W. F., M.R.C.S., L.R.C.P. *Edin.*, *Eng.*, Lyons' Terrace.
1876 | | Mackenzie, Rev. P. F., "Friendville," Paddington.
1880 | | Mackenzie, R. M., The Exchange Corner.
1876 | | Mackellar, Chas. Kinnard, M.B., C.M., *Glas.*, Macquarie-street.
1881 | | Maclean, L. H. J., M.D., M.R.C.P., *Lond.*, M.R.C.S., 26, Alberto Terrace, Darlinghurst.
1882 | | Madsen, Hans. F., "Hesselmed" House, Queen-street, Newtown.
1883 | | Maiden, Josh. Hy., Technological Museum, Sydney.
1878 | | Maitland, Duncan Mearns, junior, "Afreba," Stanmore Road.
1873 | | Makin, G. E., Berrima.
1880 | | Manfred, Edmund C., Montague-street, Goulburn.

Elected.		
1877		Mann, John, F.L.S., 19, Hunter-street.
1881		Mann, Herbert W., care of Liverpool & London & Globe Insurance Co., Pitt-street.
1881		Manning, Sir W. M., LL.D., Primary Judge, "Walleroy," Edgecliff Road, Woollahra.
1873	P 6	Manning, James, Milson's Point, North Shore.
1876		Manning, Frederic Norton, M.D. Univ. *St. And.*, M.R.C.S. *Eng.*, Lic. Soc. Apoth. *Lond.*, Gladesville.
1869		Mansfield, G.A., Pitt-street.
1878		Markey, James, L.R.C.S., *Irel.*, L.R.C. Phys., *Edin.*, Regent-street.
1878		Marklove, Robert J., Macquarie Place.
1880		Marano, G. V., M.D. Univ. *Naples*, Clarendon Terrace, Elizabeth-street.
1872		Marsden, The Right Rev. Dr., Bishop of Bathurst, Bathurst.
1876		Marshall, George, M.D. Univ. *Glas.*, Lic. R. Coll. S. *Edin.*, Lyons' Terrace.
1876		Martin, Rev. George, Cleveland-street.
1879		Masters, Edward, "Lurlei," Marrickville.
1875		Mathews, R. H., L.S., J.P., Singleton.
1879		Matthews, Robert, Tumut-street, Adelong.
1879		Mealée, E. Marin de la, Surveyor-General's Office.
1868		Metcalfe, Michael, 9, Bridge-street.
1873		Milford, F., M.D. *Heidelberg*, M.R.C.S. *Eng.*, 3, Clarendon Terrace, Hyde Park.
1876		Millard, Rev. Henry Shaw, Newcastle Grammar School.
1882		Milson, Alfred G., East St. Leonards.
1882		Milson, James, "Elamang," North Shore.
1875		Moir, James, 58, Margaret-street.
1875		Montefiore, E. L., Darlinghurst.
1850	P 4	†Moore, Charles, F.L.S., Director of the Botanic Gardens, Botanic Gardens, *Vice-President.*
1879		Moore, Fred. H., Exchange Buildings.
1850		Morehead, R. A. A., 30, O'Connell-street.
1876		Morgan, Allan Bradley, M.R.C.S. *Eng.*, Lic. Mid. Lic. R. Coll. Phys. *Edin.*, "Ashenhurst," Burwood.
1876		Morgan, T. C., L.R.C.S. *Edin.*, M.K. & Q. Coll. Phys. *Ireland*, 55, Castlereagh-street.
1883		Morley, Frederick, 47, Surry-street.
1865	P 1	Morrell, G. A., C.E., Pitt-street.
1877		†Morris, William, Fel. Fac. Phys. and Surg. *Glas.*, F.R.M.S. Lond., 53, Castlereagh-street.
1880		Moses, David, J.P., Tenterfield.
1882		Moss, Sydney, 5, Hunter-street.
1879		Mountain, Adrian C., City Surveyor, Town Hall.
1877		‡Mullens, Josiah, F.R.G.S., Eldon Chambers, Pitt-street.
1879		Mullins, John, F.L., M.A., 209, Macquarie-street N.
1865		Murnin, M. E., "Eisenfels," Nattai.
1876		Murray, W. G., 93, Pitt-street.
1876		Myles, Chas. Henry, "Dingadee," Burwood.

Elected.		
1873		Neill, William, City Bank, Pitt-street.
1879		Neill, W. J. Walter, London Hospital, Whitechapel, London, E.
1874		Neill, A. L. P., City Bank, Pitt-street.
1881		Newton, Dr. J. L., Mudgee.
1882		Norrie, Andrew, M.D., Mast. Surg., *Aberdeen* Univ., 177, Liverpool-street, Hyde Park.
1873		Norton, James, Hon., M.L.C., solicitor, O'Connell-street.
1875		Nott, Thomas, M.D. *Aberdeen*, M.R.C.S. *Eng.*, Ocean-street, Woollahra.
1878		Nowlan, John, "Eelah," West Maitland.
1880		Oakes, Arthur W., M.B., C.M., L.R.C.P., L.R.C.S., *Edin.*, "Chiswick," Ocean-street, Woollahra.
1879		O'Connor, Dr. Maurice, College-street.
1881		O'Connor, Richd. Edwd., M.A., Wentworth Court, Elizabeth-street.
1878		Ogilvy, James L., Oriental Bank, Melbourne.
1877		Olley, Rev. Jacob, Manse, Manly.
1875		O'Reilly, W. W. J., M.D., M.C., Q. Univ. *Irel.*, M.R.C.S., *Eng.*, Liverpool-street.
1882		O'Reilly, Rev. Alexr. Innes, B.A., *Cantab.*, Public School, Five Dock.
1883		Osborne, Benjn. M., J.P., Berrima.
1880		Paling, W. H., "Wonden," Cambridge-street, Petersham.
1875		Palmer, J. H., "Cairngorm," Balmain.
1880		Palmer, Joseph, 133, Pitt-street.
1882	P 1	Palmer, Edward, "Linden," Parramatta.
1876		Parrott, Thomas S., C.E., Ashfield.
1878		Paterson, Hugh, 229, Macquarie-street.
1877		Paterson, James A., Union Bank, Pitt-street.
1878		Paterson, Alexander, M.D., M.A., "Hillcrest," Stanmore Road.
1877		†Pedley, Perceval R., Carlton Terrace, Wynyard Square.
1877		Perkins, Henry A., Burwood.
1881		Philip, Alexr., L.K. and Q.C.P., *Irel.*, L.R.C.S., *Irel.*, Lylehurst House, Devonshire-street.
1856		Phillips, H., Pacific Insurance Company, 85, Pitt-street.
1876		Pickburn, Thomas, M.D. *Aberdeen*, Ch. M., M.R.C.S. *Eng.*, 40, College-street.
1879		Pittman, Edwd. Fisher, L.S., Department of Mines, Sydney.
1881		Poate, Frederic, Government Surveyor, Summer Hill.
1879		Pockley, Thos. F. G., Commercial Bank, Singleton.
1878		†Poolman, F., Colonial Sugar Refining Co., O'Connell-street.
1882		Porter, Donald, Tamworth.
1878		Potts, F. H., Want-street, Burwood.

Elected.		
1876		Quaife, Fredk. Harrison, M.D., Mast. Surg. Univ. *Glas.*, "Hughenden," Queen-street, Woollahra.
1876		Quodling, W. H., "Couranga," Bedmyre Road, Burwood.
1865	P 1	‡Ramsay, Edward, F.L.S., Curator of the Australian Museum, College-street.
1876		‡Ratte, A. F., F.L.S., The Museum, Sydney.
1874		Read, Reginald Bligh, M.R.C.S., *Eng.*, Coogee.
1868		Reading, E., Mem. Odont. Soc. *Lond.*, 33, Castlereagh-street.
1881		Reid, William, Australian Joint Stock Bank, Sydney.
1881	P 2	Rennie, Edwd. H., M.A. *Syd.*, D.Sc. *Lond.*, "Walthamston," Ashfield.
1870		Renwick, Arthur, *Sydn.*, D.Sc., *Lond.*, M.D. *Edin.*, B.A. *Sydn.*, F.R.C.S. *Edin.*, M.L.A., 295, Elizabeth-street.
1882		Renwick, Geo. Jas., B.A., M.B., C.M., *Edin.*, 257, Elizabeth-street, Hyde Park.
1880		Riddell, C. E., Union Club.
1856		Roberts, J., 340, George-street.
1868	P 3	Roberts, Sir Alfred, M.R.C.S. *Eng.*, Hon. Mem. Zool. and Bot. Soc. Vienna, Bridge-street.
1881		Roberts, C. J., C.M.G., "Chatsworth," Potts's Point.
1871		Robertson, Thomas, solicitor, 85, Pitt-street.
1882		Robertson, Rev. James Thomas, M.A., "The Manse," Tumut.
1856	P 8	†Rolleston, Christopher, C.M.G., Palmer-street, St. Leonards East.
1881		Roser, Carl, M.D.
1865		Ross, J. Grafton, O'Connell-street.
1881	P 2	Roth, Henry Ling, Fellow of the Statistical Society, *Lond.*, Fellow of the Royal Meteorological Society, *Lond.*, Fellow of the Anthropological Institute of Great Britain and Ireland Foulden Estate, Mackay, Queensland.
1882		Rothe, W. H., Union Club.
1876		Rowling, Dr., Chas., Mudgee.
1864	P 28	†Russell, Henry C., B.A. *Syd.*, F.R.A.S., F.M.S., Hon. Mem. S. Aust. Inst., Government Astronomer, Sydney Observatory,
1882		Russell, H. E., Tattersall's Chambers, Hunter-street.
1875		Sahl, Charles L., German Consul, Consulate of the German Empire, Wynyard Square.
1876		Saliniere, Rev. E. M., Glebe.
1876		Schuette, Rudolf, M.D., Univ. *Göttingen*, Lic. Soc. Apoth. *Lond.*, 10, College-street.
1883		Schulze, Oscar, 331, George-street.
1856	P 1	‡Scott, Rev. William, M.A. *Cantab.*, Hon. Mem. Roy. Soc. Vic., "The Parsonage," Bungendore.
1880		Scrivener, Charles Robert, Survey Department.
1876		Sedgwick, Wm. Gillett, M.R.C.S., *Eng.*, Newtown.
1877		Selfe, Norman, C.E., M.I.C.E., "Rockleigh," Balmain.

Elected.		
1876		Sharp, James Burleigh, J.P., Clifton Wood, Yass.
1876		Sharp, Henry, Green Hills, Adelong.
1878	P 1	Sharp, Revd. W. Hey, M.A. *Oxon.*, Warden of St. Paul's College, University.
1883		Shellshear, Walter, Assoc. M. Inst. C.E., Liverpool-street, Paddington.
1879		Shepard, A.D., care of Mr. Fleming, 22 and 24, Clarence-street.
1881		Shepherd, T. W., "Norwood," Milson's Point, St. Leonards East.
1875		Sheppard, Rev. G., B.A., Berrima.
1882		Shewen, Alfred, M.B., M.D., Univ. *London*, M.R.C.S.E, Liverpool-street, Hyde Park.
1882		Sinclair, Eric, M.B., C.M., Univ. *Glasgow*, Gladesville Asylum.
1883		Sinclair, Sutherland, Secretary, Australian Museum.
1877		Slattery, Thomas, Premier Terrace, 169, William-street, Woolloomooloo.
1877		Sloper, Fredk. Evans, 360, Liverpool-street.
1881		Smedley, John, 171, York-street.
1882		Smith, Bruce, 103, Elizabeth-street.
1852	P 6	Smith, John, The Hon., C.M.G., M.D., LL.D., *Aberdeen*, M.L.C., F.C.S., Hon. Mem. Roy. Soc. Vic., Professor of Physics in the University of Sydney, *President*, 137, Macquarie-street.
1878	P 1	Smith, Marshall, Glanville-street, Glanville, South Australia.
1875		Smith, Robt., M.A. *Syd.*, solicitor, O'Connell-street.
1874		‡Smith, John M'Garvie, Pitt-street.
1878		Smith, E. E., "Clytie," 70, Darlinghurst Road.
1883		Smith, Robt. Burdett, M.L.A., 203, Macquarie-street North.
1881		Smyth, F. L. S., M.A., F.R.G.S., Wentworth Court, Elizabeth-street.
1879		Spry, James Monsell, Union Club.
1881		Starkey, John Thos., 61, Castlereagh-street.
1882		Steel, John, L.R.C.P., L.R.C.S., *Edin.*, 52, College-street, Hyde Park.
1872	P 1	Stephen, George Milner, B.A., F.G.S., Mem. Geol. Soc. of Germany; Cor. Mem. Nat. Hist. Soc., Dresden; F.R.G.S. of Cornwall; "Almaville," Pyrmont Bridge Road.
1879		‡Stephen, Septimus, South Kingston.
1879		Stephen, Alfred F. H., Pyrmont Bridge Road.
1857		Stephens, William John, M.A. *Oxon.*, Professor of Natural History in the University of Sydney, 71, Darlinghurst Road.
1883		Stephen, Cecil B., M.A., 101, Elizabeth-street.
1878		Street, John Rendell, "Birtley," Elizabeth Bay Road.
1882		Strickland, Sir Edwd., K.C.B., F.R.G.S., "Cardowan," Manly Beach.
1876		Strong, Wm. Edmund, M.D., *Aberdeen*, M.R.C.S., *Eng.*, Liverpool.
1874		Stuart, Alexander, The Hon. M.L.A., Sydney.
1876		Stuart, Clarendon, Cross-street, Double Bay.
1883		Stuart, T. P. Anderson, M.D., Univ. *Edin.*, Professor of Anatomy and Physiology in the University of Sydney.
1883		Styles, G. Mildinhall, Commercial Bank, George-street.
1876		Suttor, Wm. Henry, M.L.A., "Cangoura," Bathurst.

Elected.		
1879		Tarrant, Harman, M.R.C.S., M.L.A., Macquarie-street.
1862	P 10	Tebbutt, John, F.R.A.S., Observatory, Windsor.
1879		Thomson, Dugald, care of R. Harper & Co., 409, George-street.
1870	P 1	Thompson, H. A., Mount Bischoff, Tasmania.
1875		Thompson, Joseph, Bellevue Hill, Double Bay.
1877		Thompson, Thos. James, 139, Pitt-street, Sydney.
1876		Thomas, H. Arding, Narellan.
1878		Thomas, F. J., Hunter River N.S.N. Co., Market-street.
1882		Thornton, Hon. George, M.L.C., 377, George-street.
1876		Tibbits, Walter Hugh, M.R.C.S. *Eng.*, "Carlisle," Petersham.
1876		Toohey, J. T., "Moira," Burwood.
1882		Traill, Mark W., L.R.C.P. *Lond.*, M.R.C.S.E., 211, Macquarie-street.
1873	P 1	Trebeck, Prosper N., Hunter-street.
1879		Trebeck, P. C., Hunter-street.
1883		Trebeck, Tom B., B.A., *Syd.*, Univ., "Leyton" 72, Elizabeth Bay.
1876		Trouton, F. H., A.S.N. Company's Offices, Sydney.
1877		‡Tucker, G. A., Ph. D., Superintendent, Bay View Asylum, Cook's River.
1868		Tucker, William, "Clifton," North Shore.
1875		Tulloh, W. H., "Airlee," Greenwich Point Road, North Shore.
1875		Turner, G., 3, Fitzroy Terrace, Pitt-street, Redfern.
1883		Tuxen, Peter Wilhelm, L.S., Survey Office, Sydney.
1882		Twynam, George Edwd., L.R.C.P. *Lond.*, M.R.C.S.E., "Cleone," West-street, Petersham.
1883		Vause, Arthur J., M.B., C.M., *Edin.*, Bay View House, Tempe.
1876		Voss, Houlton H., J.P., Goulburn.
1879		Walker, H. O., Australian General Assurance Co., 129, Pitt-street.
1867		Walker, Philip B., Telegraph Office, George-street.
1870		Wallis, William, Moncur Lodge, Potts's Point.
1882		Want, Sydney A., "Carabena," Milson's Point, North Shore.
1867		Ward, R. D., M.R.C.S. *Eng.*, North Shore.
1883		Wardell, W. W., Fellow Royal Institute of British Architects, Lond., Member Institute Civil Engineers, Lond., "Upton Grange," St. Leonards.
1877		Warren, William Edward, M.D. and M.Ch., Queen's Univ. *Irel.*, 243, Elizabeth street, Sydney.
1883		Warren, W. H., C.E., Lecturer on Engineering, University of Sydney, "Madeley," London-street, Enmore.
1876		Watkins, John Leo, B.A. *Cantab.*, M.A. *Syd.*, 121, Elizabeth-street.
1876		Waterhouse, J., M.A. *Syd.*, "Waima," Cavendish-street, Stanmore.
1876		Watson, C. Russell, M.R.C.S., *Eng.*, "Morevale," Newtown.
1877		Watt, Alfred Joseph, 528, George-street.
1859		Watt, Charles, Government Analyst, Treasury Buildings.
1876		Waugh, Isaac, M.B., M.C., *T.C.D.*, Parramatta.
1876		Webster, A. S., Gresham Chambers.

Elected.		
1882		Webster, Rev. William, "Manse," Wilcannia.
1867		Weigall, Albert Bythesea, B.A. *Oxon.*, M.A. *Syd.*, Head Master of the Sydney Grammar School, College-street.
1881		‡Wesley, W. H., Stella House, Penzance, Cornwall.
1881		West, Arthur Annesley, M.D., M. Ch. Trin. Col. Dub., L.R.C.S., F.R.C.S. *Irel.*, Derby House, Glebe.
1878		Westgarth, G. C., solicitor, "Tresco," Elizabeth Bay.
1877		Weston, W. J., 5, Spring-street.
1879		‡Whitfeld, Lewis, B.A. *Sydney*, The Grammar School, Sydney.
1874		White, Rev. James S., M.A., LL.D., *Syd.*, "Gowrie," Singleton.
1875		White, Hon. James, M.L.C., "Cranbrook," Double Bay.
1877		White, Rev. W. Moore, A.M., LL.D., T.C.D., "Claudeboye," Burwood.
1883		Whitelegge, Thomas, Orient Brewery, Bourke-street.
1874	P 1	Wilkinson, C. S., F.G.S., Government Geologist, Department of Mines.
1880		Wilkinson, Robt. Bliss, 12, Spring-street.
1878		Wilkinson, Rev. Samuel, Regent House, Regent-street, Petersham.
1876		Williams, Percy Edward, Treasury.
1879		Wilshire, F. R., P.M., Berrima.
1878		Wilshire, James Thompson, "Havilah," Burwood.
1879		Wilson, F. A. A., Mercantile Bank, Sydney.
1876		Windeyer, W. C., His Honor Judge, M.A., *Syd.*, King-street.
1876		Wise, George Foster, Immigration Office, Hyde Park.
1878		Wise, Henry, Savings' Bank, Barrack-street.
1873		Wood, Harrie, Under Secretary for Mines, Department of Mines.
1881		Wood, W. H. O'M., Surveyor-General's Office.
1879		Woodhouse, E. B., "Mount Gilead," Campbelltown.
1877		Woods, T. A. Tenison-, 110, Fitzroy-street, Moore Park.
1876		Woolrych, F. B. W., Wilson-street, Newtown.
1881		Wright, Frederic, M.P.S., Harnett-street
1872		†Wright, Horatio G. A., M.R.C.S., *Eng.*, Wynyard Square, *Hon. Treasurer*.
1878		Wright, Rev. Edwin H., St. Stephen's, Bourke.
1879		Young, John, Town Hall, George-street.

Honorary Members.

Limited to Twenty.

M. recipients of the Clarke Medal.

1875		Agnew, Dr., Hon. Secretary, Royal Society of Tasmania, Hobart.
1875		Barlee, His Excellency Sir F. P., K.C.M.G., Governor of Honduras.
1879	M	Bentham, George, F.R.S., V.P.L.S., C.M.G., The Royal Gardens, Kew.
1875		Bernays, Lewis A., F.L.S., F.R.G.S., Brisbane.
1876	P 1	Cockle, His Honor Sir James, late Chief Justice of Queensland, M.A., F.R.S., Ealing, London.
1876		De Köninck, Prof., M.D., Liège, Belgium.

Elected.		
1875		Ellery, Robert F., F.R.S., F.R.A.S., Government Astronomer of Victoria, Melbourne.
1875		Gregory, Augustus Charles, C.M.G., F.R.G.S., Geological Surveyor, Brisbane.
1875		Haast, Dr. Julius von, C.M.G., Ph. D., F.R.S., F.G.S., Professor of Geology, Canterbury College, and Director of the Canterbury Museum, Christchurch, New Zealand.
1875	P 1	Hector, James, C.M.G., M.D., F.R.S., Director of the Colonial Museum and Geological Survey of New Zealand, Wellington.
1880		Hooker, Sir Joseph Dalton, K.C.S.I., M.D., C.B., F.R.S., &c., Director of the Royal Gardens, Kew.
1879	M	Huxley, Professor, F.R.S., LL.D., F.G.S., F.Z.S., F.L.S., &c., &c., Professor of Natural History in the Royal School of Mines, South Kensington, London.
1875	M	M'Coy, Frederick, F.R.S., F.G.S., Hon. F.C.P.S., C.M.Z.S., Professor of Natural Science in the Melbourne University, Government Palæontologist, and Director of the National Museum, Melbourne.
1875	P 3 M	Mueller, Baron Ferdinand von, K.C.M.G., M.D., Ph.D., F.R.S., F.L.S., Government Botanist, Melbourne.
1879	M	Owen, Professor Sir R., K.C.B., M.D., D.C.S., LL.D., F.L.S., F.G.S., V.P.Z.S., &c., &c., The British Museum, London, W.C.
1883		Pasteur, Louis, M.D., Paris.
1875		Schomburgh, Dr., Director of the Botanic Gardens, Adelaide, South Australia.
1878		Walker, Thomas, Yaralla, Concord.
1875		Waterhouse, F. G., F.G.S., C.M.Z.S., Curator of the Museum, Adelaide, South Australia.
1875	P 14	Woods, Rev. Julian E. Tenison-, F.G.S., F.L.S., Hon. Mem. Roy. Soc., Victoria, Hon. Mem. Roy. Soc., Tasmania, Hon. Mem. Adelaide Phil. Soc., Hon. Mem. New Zealand Institute, Hon. Mem. Linnean Soc., N.S.W., &c., Union Club, Sydney.

Corresponding Members.

Limited to Twenty-five.

1810	P 1	Clarke, Hyde, V.P. Anthropological Institute, 32, St. George's Square, London, S.W.
1879	P 3	Etheridge, Robert, junr., F.G.S., &c., The British Museum.
1883	P 1	Feistmantel, Ottokar, M.D., Geological Survey, Calcutta.
1880		Miller, F. B., F.C.S., Melbourne Mint.
1880		Ward, Sir Edward, K.C.M.G., Major-General, R.E., Cannes, France.

Obituary, 1883.

Ordinary Members.

1876		Jenkins, Dr. R. L.
1877		Lord, George Lee.
1859		MacDonnell, William.
1878		Rose, W.
1880		Sandy, James.
1874		Taylor, Dr. Charles.

AWARDS OF THE CLARKE MEDAL.

Established in memory of

THE LATE REVD. W. B. CLARKE, M.A., F.R.S., F.G.S., &c.,

Vice-President from 1866 *to* 1878.

To be awarded from time to time for meritorious contributions to the Geology, Mineralogy, or Natural History of Australia, to men of science, whether resident in Australia or elsewhere.

1878. Professor Sir Richard Owen, K.C.B., F.R.S., Hampton Court.

1879. Mr. George Bentham, C.M.G., F.R.S., The Royal Gardens, Kew.

1880. Professor Huxley, F.R.S., The Royal School of Mines, London.

1881. Professor F. M'Coy, F.R.S., F.G.S., The University of Melbourne.

1882. Professor James Dwight Dana, LL.D., Yale College, New Haven, Conn., United States of America.

1883. Baron Ferdinand von Mueller, K.C.M.G., M.D., Ph.D., F.R.S., F.L.S., Government Botanist, Melbourne.

1884. Dr. Alfred R. C. Selwyn, LL.D., F.R.S., F.G.S., Director of the Geological Survey of Canada, Ottawa.

NOTICE.

Members are particularly requested to communicate any change of address to the Hon. Secretaries, for which purpose this slip is inserted.

Corrected Address.

Name ....

....

Titles, &c. ....

....

Address ....

....

....

Date ....

To the

Hon. Secretaries,

The Royal Society of N. S. W.,

37, Elizabeth-st., Sydney.

ANNIVERSARY ADDRESS.

By Christopher Rolleston, C.M.G., President.

[*Delivered to the Royal Society of N.S.W., 2 May, 1883.*]

Gentlemen,

Combining, as the anniversary meetings of the Royal Society are in the habit of doing, the close of the old year with the opening of a new one, the distinguished honor conferred upon me at our last anniversary as President for the year demands of me, before I vacate the Chair, that I should open the present session with the customary address. But before entering upon the subject of it I desire to say how sensible I am of my shortcomings, and of the kindly forbearance and support extended to me by the members who have attended our meetings. I would fain hope that my faults, having been rather those of omission than of commission, may not have resulted prejudicially either to the character or progress of the Society. The fact is that, in a young community like ours we are sadly wanting in men of leisure and of culture who have the time to spare and the knowledge to adorn the Chair of this Society—qualifications which were eminently exemplified in the person of our former Vice-president, the late Rev. W. B. Clarke, the memory of whose services in the cause of geological science in Australia, and in the interests of this Society in particular, will, I venture to think, outlive the lineaments of his person so happily portrayed on the canvas which adorns our walls.

The report of the Council, which has just been presented, gives a favourable account of the progress of the Society for the last twelve months, and it would be tedious to attempt to enlarge upon the topics referred to in that report. The most important of the

papers read during the session were those contributed by the Rev. J. E. Tenison-Woods, and especially that on "The Geology of the Hawkesbury Sandstone," which, from the novelty of its conception, the variety of the facts and observations by which his theory was supported, the clearness with which the facts were set forth, and the masterly ease which characterized the treatment of the theory propounded, is a most interesting and valuable contribution to the Society's Transactions. There was also a very interesting and valuable paper on "Tropical Rains," by my highly respected predecessor in this Chair, Mr. H. C. Russell; and also a very remarkable paper by Mr. James Manning, containing curious revelations as to the religious belief of the aborigines of New Holland—revelations made to him more than five and forty years ago, as he alleges, before the blacks had come in contact with the missionaries or other tamperers with their faith.

In casting about for a subject on which to address you this evening, it has seemed to me that I could not better occupy your attention or discharge the duty imposed on me than in bringing under view a *résumé* of the life and labours of a distinguished member of our Society, the tidings of whose death reached us subsequent to our last anniversary, and who has left behind him a name and reputation second to none in this age of scientific inquiry. Upon the roll of honorary members of our Society in the year 1879 was placed the name of Charles Robert Darwin; and whilst we did honor to ourselves in enrolling his name amongst the distinguished men to whom a like compliment has been paid, it is gratifying to know that he highly appreciated this recognition of his great services in the field of natural science.

In the month of April of last year, within the precincts of the ancient Abbey of Westminster, and near the honored grave of England's greatest philosopher, were very appropriately deposited the mortal remains of this eminent naturalist; and whatever might have been the public opinion a quarter of a century ago, no one at the present day would venture to challenge the claim that the final resting-place of the foremost scientific man of

the Victorian era should be found alongside the grave of the only other philosopher of the past whose revolutionary effect upon thought can at all be compared with his own. The discoveries of Sir Isaac Newton—the most remarkable mathematician and greatest natural philosopher of his own or any other age—can, I think, alone be brought into competition with those of Darwin, whose faithful, patient, and laborious application of the Baconian theory of induction has brought about so complete a revolution in scientific thought. We can all remember the fierce theological storm which raged about the head of this earnest inquirer after truth, who, by his "Origin of Species" and theory of "evolution," challenged ancient traditions, and gave a severe shock to time-honored principles of faith. It was soon, however, discovered that Darwin was rather a patient investigator of facts than a daring theorist, and that, whatever might be his conclusions, the mass of facts he had collected with unparalleled industry and sagacity were no inconsiderable contribution to human knowledge. It is not too much to say that had Darwin's life been cut off a quarter of a century ago, no one would have had the temerity to suggest that his memory should have been so conspicuously honored as it has been by giving him a final resting-place among England's greatest worthies. But the panic created by his discoveries has subsided, and science has at length come to be regarded, not as the enemy, but as the handmaid of religion. The greatness of the revolution that has taken place in human thought, and the abatement of honest but unreasonable alarm at modern discoveries, are vividly illustrated by the profound homage paid to the deceased philosopher by the foremost orthodox divines of the day.

The "evolution" theory, which a quarter of a century ago was denounced as leading to materialism, is now recognized as in no way alien to the Christian religion. Darwin had the happiness of living down the clamour created by his grand discoveries; and even where his theories have not been accepted, he has long since been recognized as a modest, reverent, and earnest searcher after truth. Both in Westminster Abbey and in St. Paul's Cathedral the great

preachers of the day testified to the pure and earnest love of truth which characterized the life and labours of Mr. Darwin. Canon Prothero described him as "the greatest man of science of his day, but so entirely a stranger to intellectual pride and arrogance that he stated with the utmost modesty opinions of the truth of which he was himself convinced, but which he was aware could not be universally agreeable or acceptable." Canon Barry referred to Mr. Darwin as a leader of scientific thought, showing that the fruitful doctrine of evolution, with which his name would always be associated, lent itself as readily to the old promise of God as to more modern but less complete explanations of the universe. Canon Liddon observed that, when Darwin's books on the "Origin of Species" and on the "Descent of Man" first appeared, they were largely regarded by religious men as containing a theory necessarily hostile to religion, but a closer study had greatly modified any such impression. "It is seen," he said, "that whether the creative activity of God is manifested through catastrophes—as the phrase goes—or in progressive evolution, it is still his creative activity, and the really great questions beyond remain untouched."

During forty years past, living in comparative retirement at his country residence in Kent, Mr. Darwin steadfastly pursued his experimental researches, and from time to time published their results, with those of his profound and comprehensive speculations, till he has gradually won the assent of all well-informed persons to a few grand principles concerning the development of specific forms of organic life. His theory of the origin of species, vegetable and animal, referred them to the operation of a general law of nature in the universal struggle of living organisms for subsistence, and in the competition for opportunities of reproducing their kind tending to the survival of the fittest types, and to the modification of their progeny in the course of successive generations by more and more distinctive peculiarities growing up in those organs or features which aided most effectually in the preservation of the race. Individual types of exceptional vigour, and with particular adaptation to surrounding circumstances, would thus become the progenitors of distinct species.

In his famous book, which appeared in 1859, Mr. Darwin formally announced his view of natural history. He says: "I cannot doubt that the theory of descent, with modification, embraces all the members of the same class. I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number." He seems to have looked forward even to a higher generalization, for he goes on to say that "analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype; but this inference is chiefly grounded on analogy, and it is immaterial whether or not it be accepted. The case is different with the members of each great class, as the Vertebrata, the Articulata, &c., for here we have distinct evidence that all have descended from a single parent." Darwin concludes his treatise in these impressive words:—"From the war of nature, from famine and death, the most exalted object which we are capable of conceiving—namely, the production of the higher animals,—directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been and are being evolved."

In his treatise on the "Origin of Species," from which the foregoing quotations are copied, Darwin had not actually expressed his views as to the ancestry of man, though he had left them to be very clearly inferred. He says: "It seemed to me sufficient to indicate that, by this work, light would be thrown on the origin of man and his history," for this implied that man must be included with other organic beings in any general conclusion respecting his manner of appearance on this earth. But in his work on the "Descent of Man and Selection in Relation to Sex," which was published in 1871, Darwin expressly dealt with this most interesting question. He presented man as co-descendant with the catarrhine or "down-nostrilled" monkeys from a hairy quadruped furnished

with a tail and pointed ears, and probably a climber of trees. Nay, he traced back the chain of descent until he found, as the progenitor of all the vertebrate animals, some aquatic creature, hermaphrodite, provided with gills, and with brain, heart, and other organs imperfectly developed. The treatise concludes by remarking what are the hopes which the advance of the human race in past ages seems fairly to justify. He says: "We are not, however, concerned with hopes or fears, but only with the truth as far as our reason allows us to discover it." "I have given the evidence to the best of my ability; and we must acknowledge, as it seems to me, that man, with all his noble qualities—with sympathy, which feels for the most debased—with benevolence, which extends not only to other men, but to the humblest living creature—with his god-like intellect, which has penetrated into the movements and constitution of the solar system—with all those exalted powers, man still bears in his bodily frame the indelible stamp of his lowly origin."

After the publication of his first great work, Darwin continued to gather evidence tending to strengthen his theory. In 1862 he published his remarkable work on "Fertilization of Orchids," and in 1867 his "Domesticated Animals and Cultivated Plants." In 1872 Mr. Darwin published "The Expression of the Emotions in Man and Animals"; in 1875, "Insectivorous Plants"; in 1876, "Cross and Self-fertilization in the Vegetable Kingdom"; and in 1877, "Different forms of Flowers in Plants of the same Species." Only last year appeared his work upon Earthworms, in which he traced the operations of worms in gradually covering the surface of the globe with a layer of mould, and showed the wonders produced by the operations of these insignificant creatures.

Mr. Darwin, having inherited a good private fortune, engaged in no business or profession, but devoted his whole life to natural science. And here I may mention how it came about that he visited Australia When a naturalist was to be chosen to accompany the surveying expedition of her Majesty's ship "Beagle" in 1831, Darwin was recommended to Captain Fitzroy and the

Lords of the Admiralty by the then Professor of Botany at Cambridge. He sailed with that expedition on the 27th of December, 1831, and returned to England in October, 1836, having made a scientific circumnavigation of the globe. On returning to England Darwin published a "Journal of Researches into the Geology and Natural History" of the various countries he had visited, in addition to numerous papers on various scientific subjects.

Mr. Darwin's conclusions as to the future of New South Wales, after crossing the Blue Mountains and going as far as Bathurst, are worth recording, as those of a keen observer who visited the Colony nearly half a century ago. He says: "The rapid prosperity and future prospects of this Colony are to me, not understanding these subjects, very puzzling. The two main exports are wool and whale oil, and to both of these productions there is a limit. The country is totally unfit for canals, therefore there is not a very distant point beyond which the land carriage of wool will not repay the expense of shearing and tending sheep. Pasture everywhere is so thin that settlers have already pushed far into the interior. Moreover, the country further inland becomes extremely poor; agriculture, on account of the droughts, can never succeed on an extended scale; therefore, so far as I can see, Australia must ultimately depend upon being the centre of commerce for the southern hemisphere, and perhaps on her future manufactories. Possessing coal, she always has the moving power at hand. From the habitable country extending along the coast, and from her English extraction, she is sure to be a maritime nation. I formerly imagined that Australia would rise to be as grand and powerful a country as North America, but now it appears to me that such future grandeur is rather problematical." Before his lamented death, no doubt, Darwin had seen cause to modify his early impressions, and to recognize the gigantic strides made by Australia towards the achievement of a national greatness second only to the North American Republic to which he referred.

As bearing on the interesting theory propounded by the Rev. J. Tenison-Woods, in his paper on the Geology of the Hawkesbury Sandstone, to which I have alluded, I should like to quote Mr. Darwin's impressions on visiting the remarkable scenes presented to his observation in crossing the Blue Mountains. He says: "The first impression, on seeing the correspondence of the horizontal strata on each side of these valleys and great amphitheatrical depressions, is that they have been hollowed out, like other valleys, by the action of water; but when one reflects on the enormous amount of stone which on this view must have been removed through mere gorges or chasms, one is led to ask whether these spaces may not have subsided. But considering the form of the irregularly branching valleys, and of the narrow promontories projecting into them from the platforms, we are compelled to abandon this notion. To attribute these hollows to the present alluvial action would be preposterous, nor does the drainage from the summit-level always fall, as is remarked, near the Weatherboard into the head of these valleys, but into one side of their bay-like recesses. Some of the inhabitants remarked to me that they never viewed one of these bay-like recesses, with the headlands receding on both hands, without being struck with their resemblance to a bold sea-coast. This is certainly the case. Moreover, on the present coast of New South Wales, the numerous fine widely-branching harbours, which are generally connected with the sea by a narrow mouth worn through the sandstone coast cliffs, varying from one mile in width to a quarter of a mile, present a likeness, though on a miniature scale, to the great valleys of the interior. But then immediately occurs the startling difficulty, why has the sea worn out these great though circumscribed depressions on a wide platform, and left mere gorges at the openings, through which the whole vast amount of triturated matter must have been carried away? The only light I can throw upon this enigma is by remarking that banks of the most irregular forms appear to be now forming in some seas, as in parts of the West Indies and in the Red Sea, and that their sides are exceedingly steep. Such banks, I have been led to suppose, have been

formed by sediment heaped by strong currents on an irregular bottom. That in some cases the sea, instead of spreading out sediment in a uniform sheet, heaps it round submarine rocks and islands it is hardly possible to doubt after examining the charts of the West Indies; and that the waves have power to form high and precipitous cliffs, even in land-locked harbours, I have noticed in many parts of South America. To apply these ideas to the sandstone platforms of New South Wales, I imagine that the strata were heaped by the action of strong currents and of the undulations of an open sea on an irregular bottom, and that the valley-like spaces thus left unfilled had their steeply-sloping flanks worn into cliffs during a slow elevation of the land, the worn-down sandstone being removed either at the time when the narrow gorges were cut by the retreating sea, or subsequently by alluvial action." I know not what our friend Mr. Tenison-Woods may think of these impressions. They do not agree with his own theory, and may not stand the test of the advanced geological science of the present day; nevertheless they are interesting as being the early impressions of so celebrated an observer of nature as Darwin.

I will, if you will allow me, quote the words with which he closes his chapter on New South Wales: "Farewell, Australia! you are a rising child, and doubtless some day will reign a great princess in the south; but you are too great and ambitious for affection, yet not great enough for respect. I leave your shores without sorrow or regret."

Darwin's hypothesis of evolution has been the subject of much controversy. Its adoption by such a leading scientist as Professor Huxley has led many to assume that it has been scientifically proved. But the evidence for the antiquity of man has, upon reconsideration, had its foundations severely shaken. On Darwin's hypothesis, 20,000 years would form but a fraction of the time required to bring about the result which his theory of minute changes demands. It has been argued by many distinguished geologists that the generally admitted glacial and post-glacial condition of the earth, of which the evidences are unmistakeable,

have been such as to break the continuity of mammalian life, and so to destroy Darwin's theory. He himself admits, in the "Origin of Species," 6th edition, page 330, that there is evidence of every conceivable kind, organic and inorganic, "that within a very recent geological period Central Europe suffered under an arctic climate; and the ruins of a house burnt by fire do not tell their tale more plainly than do the mountains of Scotland and Wales tell their tale of glaciation." And in the latest edition of the "Origin of Species" he says (pp. 448–50): "I had hoped to find evidence that the tropics, in some parts of the world, had escaped the chilling effects of the glacial period, and had afforded a safe refuge for the suffering tropical productions; but all the geological evidence we possess relating to that period points to conditions that would render almost inevitable a break in the continuity of mammalian life."

Dr. Page, in his "Text Book of Geology," referring to Britain and the North of Europe, says that "the large mammalia of the earlier tertiaries disappeared, and the land was submerged to the extent of several thousand feet. Sir Henry de la Beche, Sir Roderick Murchison, and Sir Charles Lyell all agree in the evidences of this glacial epoch, extending over the whole of the eastern hemisphere. Sir Charles Lyell says, in his "Principles of Geology," 11th edition, p. 253, that "in one part of the glacial period the desert of Sahara was under water between latitude 30 and 20 (a breadth of nearly 700 miles), so that the eastern part of the Mediterranean communicated with that part of the ocean now bounded by the west coast of Africa." Any retreat of the mammalia southward on the African continent would thus have been effectually cut off.

It has been confidently asserted that man had no existence in pre-glacial times, and that every attempt to prove otherwise has signally failed. Now, if before the glacial epoch man was not, but when it passed away man was there, when did the evolution take place? This is the question that has failed to receive a satisfactory solution. Everything seems to turn upon this one point—that is

the simultaneous and universal prevalence of the glacial period Could that be once firmly established, then, it is admitted, it would indeed be fatal to Darwin's doctrine. But the proof seems to be wanting that the entire globe was involved at one and the same time in such glacial conditions as would be destructive of all terrestrial life. The doctrine of evolution is thus beset with difficulties; and the true attitude of science, according to Darwin, is to accumulate facts which may unravel the mystery by which the question is surrounded.

Of all the students of nature in the present era none came up to Darwin in his patient, earnest inquiry into and collection of facts. The object of his search was truth, and whatever has been true in the life-work of Darwin will live, whilst whatever has been mistaken will die; and I think we may conclude, from all we know of his gentle spirit and honest nature, that no man—as has been well said of him—would more rejoice at the death than would Darwin himself.

Gentlemen, I hope you will not think that I am carrying my remarks on the work and character of Darwin to too great a length. I must confess to a deep admiration for the man by the study of his works. His earnestness and his modesty are distinguishing traits in his character—they inspire one with admiring interest; and even if we do not accept his creed or agree with his inferences, or if they should hereafter prove erroneous, that would not detract in the slightest degree from his fame as a naturalist, nor would it lessen the profound sense of gratitude to which his great discoveries in the field of natural science most justly entitle him.

If you would kindly bear with me a little longer, I should much wish to quote to you a few passages collected from the addresses delivered at the meeting of the British Association, held at Southampton last year, expressive of the deep sense entertained by scientific men of the highest eminence as to the loss sustained through Darwin's death. At the meeting of the British Association in Southampton, in the month of August last, the President, in

his opening address, spoke of the "irreparable loss science had sustained in the person of Charles Darwin, whose bold conceptions, patient labour, and genial mind made him almost a type of unsurpassed excellence." Professor Gamgee, President of the Biological Section, alluded to Darwin's death in these terms:—"So much has lately been written concerning that veteran in science, Charles Darwin, who will figure in the history of the human intellect with such men as Socrates and Newton, that I feel no words of mine are needed to add to your sentiments of admiration and respect. He has made for himself an imperishable reputation, as one of the subtlest, most patient, and most truthful observers of natural phenomena. His powers as an observer were, however, almost surpassed by his ingenuity as a reasoner and his power to frame the hypotheses most apt to the actual state of science, to reconcile all the facts which came within the range of his observation. We remember the time when the name of Charles Darwin, and the mention of the theories connected with his name, awakened, on the part of many, sentiments of antagonism and of unreasonable opposition; but we have lived to witness what I may term a great reparation. Even those who did not know the man and the qualities of mind and heart which have endeared him to so many, have come to recognize that in his work he was actuated by a single-hearted desire to discover the truth, and after calm reflection they have conceded that his studies and his views —like all studies and all views which are based upon the truth—not only are not irreconcilable with but add to our conceptions of the dignity and glory of God." And here I may be allowed to remark that it is impossible to study the writings of Darwin, and especially the one in which he treats of "The Descent of Man," without recognizing an undercurrent of reverent sentiment, which in one or two places finds expression in words, telling us that man differs from the animal creation, if not in physical characteristics which cannot be bridged over, at least in moral attributes, and in the ennobling belief in God, by his power of forming that conception of the Deity which, to use Darwin's own words, "is the grand idea of God hating sin and loving righteousness."

Professor Lawson again, who filled the Presidential Chair in the department of Zoology and Botany at this same meeting, opened his address by observing that, "Although the President has made eloquent allusion to the great loss which the whole scientific world has sustained in the death of our great countryman, Charles Darwin, still I am sure I shall not be thought to be doing more than is my bounden duty if I, too, from this Chair, give some utterance to the deep sense of irretrievable loss which all we in this department must feel has fallen upon us. It was on this platform more than in any other place that the great battle of the doctrine of evolution, which is so intimately connected with Mr. Darwin's name, was fought. It was on this platform that his friends and coadjutors, Mr. Alfred Wallace, Sir Joseph Hooker, Professor Huxley, and many others, expounded his views, and added by their own researches to the sum of evidence which has finally convinced all the leading scientists of the day of the substantial soundness of his speculation. There are many of us now present who will never forget the intense interest and excitement which attended the discussions which took place in the earlier days of the history of the doctrine of evolution; nor shall we forget with what bitterness Mr. Darwin's views were met on the occasion of the Association's meetings at Oxford, Cambridge, Norwich, and Exeter, nor how everything that came from his pen was regarded with feelings of suspicion and hatred; and how even his blameless and guileless character was frequently assailed by those who could only see in his works a desire to dethrone all that which they considered sacred. It is also in the recollection of all of us here how he met the attacks which were made upon him by silence, never returning opprobrious declamation or insulting sarcasm by angry or contemptuous answers. Ever conscious that his aim was to search out the truth and that only, he could afford to disregard contumely and misrepresentation. Indeed, so completely was he imbued by the consciousness that his aim was righteous, that the taunts and sneers which were lavished upon him seem to have been powerless even to vex him. Again, you in this department will remember how these

attacks year by year grew less frequent and less bitter, how wholesale denunciation gave place to legitimate questionings of particular points, and how even personalities at last gave place to general professions of esteem and respect, till at last, but a few short months ago, we witnessed the burial of his remains in the national mausoleum, and saw his coffin followed not only by scientists and laymen, but by priests of various religious denominations, all of whom sought by their presence to testify to the recognition of his great worth, and perhaps some to atone in a measure for the unjust things which they might have said or thought about him when they were unacquainted with his character, and only half acquainted with the object and nature of his labours. But although our hearts are still sore at the remembrance of our loss, there are many things the reflecting upon which may well console and reconcile us to it. In the first place, he had been spared to us till such a time as we were able to walk without further needing the assistance of his guiding hand. In the next place, his life, although far from having been free from suffering, had been prolonged to a green old age, and he was able and delighted to work almost to the very day of his death. He had the satisfaction of looking back on a long life happily and worthily spent, and of living to see the doctrines which he had promulgated gradually acknowledged, and finally universally accepted. He was surrounded by devoted friends, and regarded by all naturalists with a reverence and affection such as has fallen to the lot of none since the time of Linnæus."

There is still one further tribute to the beauty of Darwin's character, and to the estimation in which he was held by his contemporaries in science, which, coming from the lips of the President of the Royal Society of England, should not be omitted. In his address at the anniversary meeting of the Society, on the 30th November last, Dr. Spottiswoode said: "Of Darwin and his works it is not for me to speak. Others with wider knowledge, after long intercourse and with greater authority, have said what was possible at the moment, and the full story of his life

is now being written by faithful hands. But I consider it no common piece of fortune to have lived within an easy distance of his house; to have been able by a short pilgrimage to enjoy his bright welcome and his genial conversation, and to revive from time to time a mental picture of that, my ideal of the philosophic life."

Such are the evidences collected from amongst many of the estimation in which Darwin was held by men of the highest eminence in the scientific world, and I feel that no apology is needed for introducing them to your notice in this *résumé* of this distinguished man's life. It will be remembered that at our monthly meeting in September last a resolution was proposed by your President, and adopted by the members present, expressive of our sympathy with the widow and family in their bereavement, and of the irreparable loss the scientific world has sustained in Darwin's death. The resolution was couched in these terms:—"The members of the Royal Society of New South Wales having heard with deep regret of the death of Charles Robert Darwin, one of their most distinguished honorary members, desire to express their sense of the loss they, with the whole scientific world, have sustained, and they desire that the expression of their heartfelt sympathy shall be conveyed, through their President, to the widow and family of the late distinguished naturalist." To his letter conveying this resolution Professor Liversidge has shown me a reply from Mr. Francis Darwin, in which he says: "My mother has been very much touched and gratified by the sympathy so abundantly and kindly expressed by Societies like yours. The strong sympathy and interest which my father felt in science in the Colonies makes us value your letters especially. I am afraid my formal letter sounds cold and stiff, but I do assure you we all feel grateful for the kind thoughts which dictated the letter to my mother."

I should not wish to close this address without referring to the great calamity which befel this community, and particularly our scientific friends, the members of the Linnæan Society, in the destruction by fire of the Exhibition Building,

commonly known as the Garden Palace, which occurred since our last anniversary. The building had been made the depository, not only of many valuable records belonging to the Government, but of the very valuable collection of geological specimens purchased by the Country, from the representatives of our former friend and distinguished Vice-president, the Rev. W. B. Clarke. These, with their accompanying notes, were all consumed in the flames, and with them the entire library of the Linnæan Society, comprising many works of rare excellence, difficult to replace. A resolution was passed at our meeting in October last expressing the regret and sympathy of the members of the Royal Society, and was forwarded by your President to the President of the Linnæan Society, with an offer of such assistance as the use of our rooms for their meetings might afford. The offer was courteously acknowledged, with the intimation that the accommodation afforded by the Free Public Library was sufficient to satisfy their present wants.

It is fitting, moreover, that I should notice the disappointment which attended the efforts of our able and popular Astronomer for the observation of the transit of Venus. Unfavourable weather over the whole of the Colony frustrated his well-laid plans for the observations at each of the stations selected for the purpose; and I believe that the Queensland observers specially appointed from home were equally unfortunate. I am certain that I express the sentiments of every member of the Society when I say that Mr. Russell had the sympathy of every one of them in his disappointment, not only on public but on private grounds; for we know how much time and thought, trouble and anxiety, the preparations cost him, and how keenly he felt the failure of them. Special expeditions for the observation were organized in England for the following places, viz. :—Madagascar, the Cape of Good Hope, Bermuda, Jamaica, Barbadoes, Queensland, and New Zealand. The promise of hearty co-operation by Mr. Russell in New South Wales, and by Mr. Ellery in Victoria, rendered any special assistance from home quite unnecessary in the case of these Colonies. The results of the observations that have proved successful have yet (I believe) to be made public.

And now, gentlemen, I will detain you no longer than is necessary to reiterate my acknowledgments of the consideration extended to me during the time I have had the honor of filling the Presidential Chair, and to express a hope that the interest in the work we are engaged in may be sustained, and the progress of the Society as satisfactory for the time to come as it has been in the time that is past. I cannot, however, vacate the Chair without placing upon record my sense of the important services rendered to the Society by, and of the obligations we are under to, our Honorary Secretaries. It is not too much to say that to the indefatigable labours of Professor Liversidge and Dr. Leibius are, in a very great measure, owing the progress, the usefulness, and the popularity attained by the Royal Society. Indeed I think I am not exaggerating when I say that the Society is acquiring such a status in the public estimation that we may, without presumption, look forward to the time when its advice and assistance on questions of public interest involving scientific inquiry may be sought by the Government of the Country. To achieve this high position should be our constant aim, and thus—although at a respectful distance, perhaps—should we be found treading in the steps of our great English prototype.

Before I sit down I desire, on behalf of the Council, to invite special attention to that clause in their report which refers to the state of the building fund. It seems to the Council very desirable that the debt upon the building should no longer form a charge upon the funds of the Society; and it is hoped that, by special efforts on the part of its members, my successor in the Chair may be able to announce at our next anniversary that the debt has been wiped out.

Of the Aborigines inhabiting the Great Lacustrine and Riverine Depression of the Lower Murray, Lower Murrumbidgee, Lower Lachlan, and Lower Darling.

By PETER BEVERIDGE.

[*Read before the Royal Society of N.S.W., 6 June, 1883.*]

IN commencing this paper, I may premise that the whole of the information herein set down has been gained by my own observation; and, moreover, the greater portion of it was obtained before the aborigines became sophisticated by contact with Europeans and their ways. My opportunities of observing the aborigines and their habits extend to a period of twenty-three years, that is to say, from 1845 until 1868.

The tribes herein treated of inhabit the Great Lacustrine and Riverine system of rivers and creeks which the Lower Murray takes from Moama to Wentworth. They comprise the *Boora Boora*, the *Baraba Baraba*, the *Watty Watty*, the *Waiky Waiky*, the *Litchy Litchy*, the *Darty Darty*, and the *Yairy Yairy* tribes. Each tribal name being the negative of the dialect spoken, and when I say that these dialects are as distinct from each other as are their negatives, philologists can readily imagine what an insurmountable task it would be to endeavour to reduce these dialects to a written language, with the view to its universal application. To obviate the difficulties which would naturally arise from the diversity of dialects, in their tribal and commercial communications (even the Australian tribes have commercial relations with each other), each tribe possesses a *Ngalla Wattow* or postman, who can speak and understand the dialects of all the tribes within a radius of 150 miles. The persons of these officials are held sacred, even by tribes which are at feud with their own; they therefore negotiate all matters of barter and tribal policy—as a consequence they are kept pretty constantly on the move. Singular to say, these *Ngalla Wattows* are, without exception, all more or less imbecile or silly, still they perform their respective functions most admirably. In physical development these men are all small, very wiry and attenuated,—their constant travelling and short commons on their many tribal missions not being conducive to the making of flesh.

The articles of commerce which the aborigines exchange with each other consist of reeds for spears, red ochre and chalk for painting purposes, stone for tomahawks, fibre for nets and cord, opossum cloaks, wood for weapons, &c. Some of these articles are peddled backwards and forwards, even as far as the Tropic of Capricorn, each tribe gladly exchanging its local productions—of which it has abundance—for such commodities as are the produce of other tribal territories, and in which their own locality is altogether lacking. At first, this doubtless seems a very primitive kind of commerce, but really, it was ample for all the simple requirements of these savage tribes, ere the advent of the civilized race gave to them tastes and wants which, until then, were altogether foreign to their nature.

It will thus be seen that the *Ngalla Wattow*, or aboriginal postman, is about the most central figure in tribal life; as a consequence thereof, he is respected and revered far above any other aboriginal character.

Of Chieftainship.

Unlike other savage races, these people have not any hereditary or elected chiefs or rulers of any kind, to whom, in time of need, either as leader in war or arbiter in tribal difficulty, they can go. With regard to the former, however, it is of very little consequence, inasmuch as these people are by far too cowardly to fight in a straightforward manner and in daylight, where the services of a leader would be of the first consequence.

Amongst higher races cowardice is held in thorough contempt, but that failing being innate in the aboriginal character, it should be viewed as a peculiarity of race rather than otherwise, and so deemed a physical imperfection only, which it doubtless is, else there would be exceptions, and to this rule there is not one even to prove it.

The oldest man in the tribe is, to some small extent, looked up to beyond his fellows, but this quasi respect is only shown him by reason of his being able to recount incidents, legends, and thrilling adventures (of which latter he is invariably the hero) that are beyond the ken of the others, and more than probable only had birth in his own fertile imagination; he, however, carefully dates the period of these occurrences far enough back to preclude the possibility of his being taxed with either plagiarism or romance.

It is in the long, bright, starry nights when these old fellows are seen and heard to perfection: it is at such times that they shine in all their self-glorification, which may almost be seen exuding from their pores, so patent is it, if their audience be numerous and attentive.

When there happens to be a dozen or two of one tribe camped together, and food is abundant, after supper, when the stars are

twinkling brightly and the camp fires glowing, one of these old fellows will get up, nude as he came into the world (with the exception of his waist-belt, which is of the narrowest), place his back to the fire, and with a grand flourish of his throwing-stick (which he holds in readiness to emphasise his flowing periods) to attract the attention of his audience, who, nothing loth, subside into silence, and so remain for hours together, with perhaps an occasional ejaculation of wonder, listening with mouths and ears agape to the savage stories and legends of the ancient narrator, who never seems at a loss for matter, and it is only when tired nature asserts herself that these savage seances come to a termination.

These legends and histories, in fact all their knowledge, is thus kept alive, and so handed down from one generation to another; therefore whatever cannot be woven into an entertaining narrative, for tribal amusement during the long nights, is entirely lost and forgotten. As a matter of course, this therefore quite accounts for their paucity of historical or any other kind of lore, and the entire absence, as well, of anything like reliable testimony as to their antecedents; that is to say, if we endeavour to trace them back for several generations. Any telling incident, however, such as a sanguinary midnight conflict, may not be altogether forgotten even after a lapse of twenty years or so, and they will speak freely enough about it in a general way, but it is quite impossible to get them to individualize or even particularize upon the subject, as from the moment of a man's death his name is never again spoken, and should there be another in the same tribe bearing the same name (as frequently happens) he immediately adopts another.

Thus, much that would have been available information, but for this superstitious craze, is completely lost. From this it will be readily seen that the Australian aborigines are merely a people of the day, to whom events of the past, however interesting, are as though they had never been; in short, figuratively speaking, they are a people to whom grandfathers have not been vouchsafed.

Proportion of Sexes.

In all the tribes the males preponderate very considerably. This is not because of the paucity of female children born, as, at birth, the sexes are about equal. The mortality amongst the females after the age of puberty is attained, however, is far greater than it is amongst the males, and for this aboriginal feature there are abundant reasons, amongst which their early maternity is not one of the least. I have seen girls frequently, of not more than eleven or twelve years old, becoming mothers; and child-bearing at these tender years entails future infirmities, which materially assist in carrying them off ere they have well reached maturity. Then,

again, their husbands convert them into perfect beasts of burden, making them carry loads sufficient almost to break down horses, much less weak women; besides that, they ill-use them otherwise most brutally, often—yes, very often, killing them outright in their ungovernable periods of passion. When an accident of this kind happens the other members of the tribe do not pay the least heed to it; it is only a *lyoor* (woman), and a husband has a perfect right to chastise his wife to death's door, and even beyond its portals, if he feels so disposed. The loss is not a tribal one, as the death of a male adult would be; at least it is not considered so, as it merely affects the individual, and he soon discovers that it does so; for when his fire needs replenishing, or his *coolaman* (water bucket) requires filling, he has either to do them himself or go cold and thirsty.

Wanton profligacy is another fertile source of disease and death amongst the women. In speaking of this source of mortality, I know that, in general, it is supposed that the venereal disease amongst the aborigines is entirely due to Europeans, but a greater error than this never had promulgation, for long before the advent of the white man it was one of the vilest scourges this primitive people had to bear. The probabilities are that the trepang-hunting Malays and Chinese first introduced it on the northern coast, centuries ago, whence it spread from one tribe to another, until at last the foul disease became a national calamity.

The women being constitutionally weaker than the men, therefore less able to run away and hide, during the frequent midnight massacres, are more liable to fall into the clutches of their relentless foes than men. Besides, at those times of extreme peril, they become perfectly paralysed with terror, and thus fall an easy prey to the ruthless assassins. The victims, therefore, of these slaughters are most frequently females; next in order comes children of tender years, and then bed-ridden old men. Such a thing as a chivalrous endeavour on the part of the men to protect the weaker portions of the tribe during those panics, or indeed at any other time, is quite unknown; in fact, it would be deemed derogatory to aboriginal manhood to run the slightest personal risk for any such Quixotic purpose; but then, in all phases of aboriginal life, self-preservation is the only law, and unanimity towards that end is not in accordance with their innate instincts. Everything they do, in short, is done instinctively; they never by any chance arrive at a conclusion by sheer force of logical reasoning.

Marriage Relations.

The marriage relations of these people are of the most primitive and simple character, the noun "*love*" being entirely lacking in their vocabulary. Nothing in the guise of courting or company-keeping is attempted by the prospective bridegroom and bride. The

bridegroom and father, or guardian (as the case may be) of the intended bride, come to a proper understanding, and the latter simply desires the *moorongoor* (girl) to pick up her belongings and take herself off to the *loondthal* (hut) of her future lord and master. Should she demur, as is frequently the case, the coercion of a *nulla nulla* (bludgeon) is resorted to, and it seldom fails to have the desired effect. There is not the faintest trace of any ceremony connected with this tie — it is merely a matter of mating. Still, it is binding enough, at least as far as regards the woman; the man at any time, however, can cut the knot, and send the woman back to her people, by whom she is received readily enough, and there is not any trouble or bother about it. There may perhaps be a slight coolness displayed by the father or other guardian of the girl towards her some time husband, for a few days, but further than this there is not any dispute or quarrel on the subject of the slight. (Their dialects, however, being altogether guiltless of a synonym for that noun may account for their calmness under the circumstances.) The girl, of course, is again ready to be disposed of to the first eligible aspirant who may offer, even although her first matrimonial venture had resulted in the production of an infant. The new lord has of course to take the encumbrance along with the mother, which he readily does, and feels proud too of what will, in the future, be deemed his putative paternityship.

Polygamy is allowed to any extent, and this law is generally taken advantage of by those who chance to be rich in sisters, daughters, or female wards, to give in exchange for wives. No man can get a wife unless he has a sister, ward, or daughter, whom he can give in exchange.

Fathers of grown-up sons frequently exchange their daughters for wives, not for their sons, however, but for themselves, even although they already have two or three. Cases of this kind are indeed very hard for the sons, but being aboriginal law they must bear it as best they can, and that too without murmur; and to make the matter harder still to bear, the elders of a tribe will not allow the young men to go off to other tribes to steal wives for themselves, as such measures would be the certain means of entailing endless feuds with their accompanying bloodshed, in the attempts that would surely be made with the view of recovering the abducted women. Young men, therefore, not having any female relatives or wards under their control must, as a consequence of the aboriginal law on the subject, live all their lives in single blessedness, unless they choose to take up with some withered old hags whom nobody owns, merely for the purpose of having their fires cared for, their water-vessels filled, and their baggage carried from camp to camp.

This ill-assorted kind of engagement is, however, not of very frequent occurrence, as the young men are too much afraid of the ridicule which their more fortunate fellows would surely shower upon their all too uxorious heads.

In their matrimonial engagements great deference is paid to consanguinity, the very slightest blood-relationship being a definite barrier to that connection; in their sexual intercourse, however, they are not the least bit particular, consequently incest of every grade is continually being perpetrated; chastity, as civilized people appraise that virtue, is quite unknown amongst them, and it is altogether a hopeless task endeavouring to make them understand the beauties and value thereof.

In speaking to them on this not very choice subject, they point to all the animals in nature and say, "These are not restricted in any way, why then should we be? Such trammels and prohibitions may be quite correct as regards white men, but not being in accordance with our ethics, and never having been the rule of our progenitors, we cannot see why we should ignore that which our forefathers deemed good merely because white men, who do not understand black-fellows, tell us to do so." Of course to arguments of this kind, and so put, especially when your opponent is an untaught and nearly, if not quite, unteachable savage, there is not any possibility of reply.

Much of this absence of chastity is due to the promiscuous manner they have of huddling up together in their *loondthals* (huts), and to the coarse, obscene, and lewd character of the stories in which are spent so many of their evenings round the camp fires; all their facetiæ, too, are of the same broad gross nature; were it not so, it would fail to meet with the appreciative audiences which sit silently for hours together drinking in the foul pruriency of the savage story-teller. Considering that all these lewd tales with their accompanying gross facetiæ are related in the presence of the children, it can scarcely be matter for wonder that they should grow up into men and women, possessing but hazy notions concerning chastity and its many beauties. It frequently happens that two brothers-in-law fall out and quarrel. Should the difference assume a serious aspect, the first thing they do is, each sends off his wife to her brother, thus getting back their respective sisters (as wives are always obtained by exchange, the relationships of brother and sister-in-law, are usually double ones). The fact of them each having babies does not in any way militate against the custom. Of course the children in these cases go with their mothers. Disputes the most trivial very often result in these summary denouements, and against which the poor women dare not say one word, however much their aversion may be to the harsh proceeding. This cruel law is one of the rights inherent to aboriginal

manhood, which cannot be controverted. As a natural consequence, the right is frequently exercised. Sometimes however, regret will supervene, the misunderstanding of the brothers-in-law become adjusted, and in due course, the wives return to their original partners.

When a woman becomes a widow, she falls back to her father, brother, or guardian, as the case may be, not in any instance does she go to her late husband's relations; if she is not too old, she is again exchanged away, her children, if any, going with her. If on the other hand, she should be too old to tempt the happy owners of marriageable girls, she becomes a waif and drudge in the tribe; that is to say, unless some one of the enforced bachelors* should deem her fitted to attend to his wants; if so, he has only to make his wishes known, when the sable widow gladly accepts his protection.

These innumerable choppings and changes make it almost impossible to tell the true paternity of many of the children, but as there is not any property depending upon legitimacy, heirship or the contrary is of but little importance, and a bar sinister in an aboriginal's genealogical tree is not deemed derogatory in any sense.

Children, their lack of training.

The children do not receive any schooling; when old enough to run about they do just whatever seems mete to their savage instincts, without the slightest reference to any one,—their parents never by any chance endeavour to guide them aright; in short, they do not possess, or even attempt to possess, the very remotest control over their progeny. It is true that sometimes in a burst of passion a father will give his child a blow with a waddy, which as likely as not will well nigh brain the little savage; this sort of training, however, only results in a wild fit of bellowing, together with a period of sulks, more or less extended, according to the evanescence, or the contrary, of the pain inflicted.

Aboriginal parents never use any means calculated to inculcate patience, endurance of pain, or privation, into the youthful character, therefore both adults and children are woefully deficient in the attributes pertaining to these virtues. Unlike children of other races, these have not any sports or pastimes relating to the years of childhood alone, their youthful amusements being merely the occupations of their riper years in miniature. Thus, in figurative language it may be said, that with these people there is not any period of boy and girlhood amongst them, boys and girls being men and women from the time they can run alone, only of a lesser growth.

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* Enforced bachelors. Those men not having any sisters or wards to exchange for wives.

Dress and Ornament.

In dress there is not the least difference between that of the male and female, the opossum cloak being the only wear of both sexes, and in both it is worn in exactly the same manner, and that is somewhat after the fashion of the Roman toga, across the shoulder with one arm free. On the very old men and the young women it is an exceedingly graceful garb. The men wear a belt round the loins under the cloak, whilst the women wear a band round the same portion of the person, from which depends a thick fringe all round about a foot in depth; the fringe is made of innumerable strips of opossum or wallaby skin; on the upper portion of both arms male and female wear armlets, also made of opossum skin; besides these they wear a netted band about an inch and a-half wide round the brow; this band is coloured red with ochre, mixed in fat, from time to time, therefore in general the circlet is gaudy and bright, and rather pleasing than otherwise. Round the neck both sexes wear strings of reeds cut into sections of an inch long, which, when carefully dried, are of a clear pale straw colour; these reed necklaces are admirably calculated to form an agreeable contrast to their ebony-hued necks and shoulders, more especially when these portions of the person have been recently well anointed with cod-fish fat. They also make necklets from the antennæ of the great Murray lobster, which, when the fish have been cooked, are of a bright red coral tint. They are broken into half-inch sections and threaded on kangaroo tail sinews; these with two kangaroo teeth attached to the hair by means of gum, just over the ears, and a bone or short section of reed through the septum of the nose, make up all the ornaments with which they are delighted to decorate themselves. Not having any festive periods in their calendar, they merely adorn themselves with these ornaments as the whim takes them, or for lack of other occupation.

Practices on attaining the age of puberty in the boys, and prior thereto—physical capacity.

When the boys arrive at the age of puberty the two front teeth of the upper jaw are knocked out. This operation is performed by the *Baangal* (doctor) of the tribe, and the manner of the operation is of the most primitive kind. Two holes, about a foot apart and twelve or fourteen inches deep, are sunk in some secluded place at a distance from the camp, where the subject to be operated on is taken by his father if he have one; if not, then his next of kin has to see him through the ordeal. Arrived at the spot, the boy's feet are placed one in each hole, his father then kneels on the ground behind him, placing his arms under those of his son, and bringing his hands together over his brow; the head of the subject is then drawn firmly back against his father's breast, when

firmly fixed in that position the *Baangal* advances with a wooden punch made hard by fire; this rude implement is placed against the teeth to be extracted, and then, with one smart blow on the punch with a tomahawk the operation is completed, and the hitherto boy has become a man. For three months after this cruel ordeal the young men are not allowed to look at a woman, young or old, as the sight of one during this probation would be the means of entailing numberless misfortunes, such as withering up of limbs, loss of eyesight, and, in fact, general decrepitude.

Prior to the period when the youths are made young men of, they dare not eat of emu flesh, wild turkey, swans, geese, or black duck, or of the eggs of any of these birds. Did they infringe this law in the very remotest degree their hair would become prematurely grey, and the muscles of their limbs would waste away and shrink up.

Any members of the tribe having malformations of the limbs or other parts of the body are pointed out as living examples of the dire fate of those who knowingly commit a breach of this aboriginal law. These poor cripples who are thus pointed at by way of illustration have had it impressed upon their minds from their earliest youth that their respective infirmities are entirely due to such indiscretions; so persistently has this been iterated and reiterated in their presence, they can scarcely help but give implicit credence to the story. Having such dread penalties so continually placed before them, the various kind of tabooed food are carefully avoided by the youths of the tribe; thus the full grown men and women come in for many of the good things of aboriginal life which they most certainly would not but for this law. Nathless the framers of this wise (?) decree were sensible in their generation, and their descendants to this day reap the benefit of their remarkable wisdom.

As a rule the aborigines have not any great capacity for physical endurance, at least they cannot compete with average white men. When violent and long drawn-out fatigue chances to be the order of the day they have thews and sinews enough too—in fact usually their whole physical development is unexceptionable, but unfortunately they lack what is commonly called pluck, therefore it requires but a very small matter beyond common to make them give in; they, however, always evince a certain amount of shamefacedness at such times, as is obvious enough by their invariably attributing their apparent want of stamina to the fact of their having a sore finger or some equally trivial ailment. They can bear the pangs of hunger, however, to a most remarkable extent; a whole week's starvation is not by any means an uncommon occurrence with them, more especially during stormy winter weather. During those inhospitable times though, nothing will induce them to stir out of their camps; indeed, they will

scarcely make use of sufficient exertion to turn themselves round, unless perhaps when they fancy it will lessen their discomfort in some small degree, if they can elaborate enough of energy to enable them to give their waist-belts an extra twist, thereby contracting the vacuum which lack of food has made so painfully apparent.

SIGNS OF MOURNING FOR THE DEAD.—OF SEPULTURE, AND THE CEREMONIES CONNECTED THEREWITH.

When men of consideration or young people die there is much mourning and grief in the tribe, and with those related by blood to the deceased the mourning takes the shape of very violent physical suffering. They (the relations) score their backs and arms, even their very faces don't always escape, with red hot brands until they become hideous with ulcers. These ulcers stand them in good stead, however, in this way: if their grief is not sufficiently acute to induce a genuine cry, they have only to come roughishly against the ulcers, when they will have cause enough for any quantity of lachrymosity. At sunrise and sunset, the one who is principally bereaved begins to cry or howl in a long monotonous kind of yodeling tone, which is immediately taken up by old and young. At first it is begun in a low cadence, but gradually it swells into such volumes of uncouth, excruciating sound as is not heard under any other circumstances. The mourning cries at a good large wake are considerable, and not by any means pleasing to the cultured ear, still they are as the music of the Spheres when compared to the hellish din created by a large campful of aboriginal mourners.

Each period of daily mourning lasts for about an hour; the remainder of the twenty-four hours they, to all appearance (but for the mourning paint), are as free from grief as though that evil were not common to all humanity. Of course every member of the tribe has his or her head plastered over with a white pigment, which they manufacture by burning gypsum, and then mixing it with water until the required consistency is achieved. The face is also painted with the same stuff, in such designs as best pleases the taste of each individual savage, there not being any recognized rule for tribal mourning decorations. When all the members of the tribe are so adorned, they give as perfect a representation of a host of demons as the most imaginative in demonology could well portray, and a stranger unacquainted with the aborigines and their customs, coming suddenly on an encampment tricked out in this guise, could hardly be blamed if a thrill of real terror did imbue his every nerve.

They prepare their dead for burial by wrapping them up tightly in the cloak which they wore during life, winding numberless plies of cord round the body to keep the cloak in its place. This

operation is performed as soon as the body becomes rigid, and when completed, it is borne to the grave at once. The graves are usually about four feet deep, and in every instance bearing east and west. In the bottom of the grave a sheet of bark is placed; or should bark be difficult to procure, it is thickly strewn with grass instead; the body is then let down with the feet towards the east. All the property which belonged to the deceased, such as weapons, nets, &c., is laid beside the body; then sticks are placed across the grave, the ends of which rest on ledges a few inches above the body; over these, and crossing them at right angles, sticks the length of the grave are arranged, then bark or a good thick covering of grass hides the body from sight and prevents the earth, which is now filled in, from coming into contact therewith.

When all this is properly completed, the relations of the deceased fling themselves prone upon the grave, howling, tearing their hair out by handfuls, and rubbing earth over their heads and bodies in vast quantities; besides this, they rip up the green mourning ulcers in the most loathsome manner, until with blood and grime combined they present a ludicrous and ghastly spectacle. There is about an hour of these proceedings before the ceremony terminates; after it is concluded the mourners trudge back to the camp in twos or threes; on their arrival there they sit down silently and stolidly for about an hour, after which, they again wake up into every day activity, their grief from thenceforth is forgotten, unless at the morning and evening intervals of prescribed mourning. The self-inflicted sores, however, remain long unhealed, and no doubt have the effect of keeping their bereavement fresh and green in their memories.

Should the person buried have been esteemed of consideration prior to death a neat hut is erected over the grave, the covering thereof being generally thatch, made of a hard knotty grass, having many joints, probably, therefore, akin to polygonum. This thatch is firmly secured to the frame by cord, many hundred yards of which are used in the work.

On some occasions a net is made, having meshes 4 inches square, with which the hut is completely enveloped.

These mausoleums cover the grave entirely; they are about 5 feet high, and are of an oval shape; a small opening or doorway is left at the eastern end; these openings are never more than 30 inches high, only being large enough to allow of a full grown man creeping in; the tops of the graves or floors of the huts are covered with grass, which is renewed from time to time as it becomes withered. The tombs are enclosed by brush fencing, the forms of the enclosures being of a diamond-shape; the tomb in every instance is exactly in the centre; all the grass inside of the fence is neatly shaved off, and the ground swept quite clean. It

is kept in this tidy condition for two or three years; after the lapse of that time, however, the whole arrangement is left to dwindle to decay, and after a few more years the very site of it is forgotten.

When a first-born child dies, should it be a son (if a daughter it is hidden out of sight as soon as possible), and under two years of age, instead of being buried in the usual manner, the little body is tightly swaddled in a cloak, well fastened round with cord, until it assumes the appearance of a long narrow bundle, without, however, showing the outline of the figure, as is the case with a body prepared for burial, but looking exactly similar to a bale of skins ready for dispatch to market. This bundle the mother carries with her wherever she goes, and at night sleeps with it by her side; and this loathsome custom she continues to carry out for six months, until, from decay, nothing but a few bones remain in the bundle; after this, the bones are put in the ground and forgotten.

These decomposing atoms of mortality do not tend to render the atmosphere in the vicinity of the camp either pleasant or healthful, still, these benighted savages bear with the offensive effluvium without the slightest murmur, deeming it, doubtless, one of those sacred customs which have been habitual to them from the remotest period, and which to omit would be sacrilege of the very worst.

When very old women die or wittals of long standing, of whom there are generally a few in each tribe, a shallow hole is merely scraped in the most convenient spot, having due regard to proximity and softness of soil, wherein the body is carelessly thrown without the slightest preparation or ceremony, covered up and forgotten, unless, indeed, the shallow grave chances to be scraped out by the hungry dogs of the camp, which is not by any means unusual, and the poor remains of humanity voraciously devoured by the ghoul-like brutes; then, instead of viewing this disgusting desecration with horror, they actually make merry thereon, bandying obscene facetiæ with each other on the subject; such occurrences, in fact, being deemed fitting in every respect for the display of their vile and prurient wit.

Brevity of Aboriginal Life.

The Sick and how attended—Bleeding and other modes of cure—Snake-bite and its treatment—Obstetrical.

Length of life is not a feature that pertains to these people; in most subjects, old age sets in ere thirty-five years have been attained; in fact long before these comparatively few years have been passed they are quite grey, and frequently bald. About that time, too, their muscular development begins to tend towards attenuation; few of the women reach even those years, being

mostly worn out by drudgery and disease together before they are well past their teens. Unless in the cases of old worn-out women, or bed-ridden subjects of long standing, who are grudged the very slightest attention, the sick are attended carefully enough. Not being subject to infectious diseases, those attending the sick have not the least fear of contracting the illness from a patient during their ministrations; in fact, they are quite ignorant of the nature of infection, and are not aware that disease can be contracted by coming into contact with or breathing the same air even as patients suffering from ailments do.

Phlebotomy is practised to a very considerable extent for many of their ailments; it is performed upon the cupping principle merely, their surgical knowledge being too limited to allow of their understanding the efficacy of opening one of the larger veins. When blood-letting is desirable, their cupping operation is effected in the following manner:—The part from which they wish to draw the blood is scarified pretty deeply by means of a sharpened mussel shell; when this has been done sufficiently well, the operator sucks the wound with his mouth, spitting out the blood from time to time, until he feels satisfied that sufficient has been extracted. Much relief is afforded by this practice to those suffering from headache, inflammation of the bowels, ophthalmic sore eyes, &c., all of which ills prevail amongst the aborigines to an unenviable extent.

For pulmonary affections and rheumatic fevers (these two diseases are very common and very fatal in the aboriginal tribes) they make use of the vapour bath, from the use of which much benefit is obtained. The bath is constructed in a very primitive though at the same time very effectual manner. A hole long enough and wide enough to hold the subject to be operated on is dug to a depth of about 18 inches; it is then filled with firewood to the top and ignited, when the wood is all consumed the ashes are scraped out and damp pine leaves filled in to the thickness of a foot; over the pine leaves an opossum cloak is spread and the patient placed carefully thereon; he is then covered all over, with the exception of his face, with another cloak, then all over the cloak earth is spread of a thickness capable of retaining the steam without weighing too heavily upon the patient; to attain the former and obviate the latter the finest earth that can be procured is only used, that is in the absence of sand, sand in all cases being preferred when comeatable.

During the progress of the bath the perspiration exudes from the face in great globules, and the hair becomes quite wet from the same cause, a female attendant is seated by the side of the patient, and it is her duty to wipe off the perspiration as occasion requires, the napkin used for this purpose being a soft piece of the ever useful opossum skin.

When the *Baangal* (doctor) thinks that the patient has been steamed enough, he is removed from the pit carefully, and expeditiously rubbed dry, after which he is closely rolled up in cloaks, and placed so that a breath of wind cannot reach him.

Although the aborigines are perfectly well aware of the vast benefit which patients suffering from many complaints derive from the use of these baths, it is but seldom that their efficacy is tested, simply because the preparation of them entails more labour than they care about expending, unless indeed in extreme cases, or when the patient is held in high estimation by the tribe; then, of course, no degree of trouble is deemed burdensome.

Hot sand baths are also used for local application, more especially for rheumatic affections of the joints. The sand is heated by simply being poured on to a fire, prepared to that end only, and allowed to remain there until the fire is consumed, when it is withdrawn in portions as required, such portions being brought to the right temperature by the admixture of cold sand. The sand as prepared is applied by the *Baangal* to the affected part: he takes it up in double handfuls, and holds it against the seat of pain, and as the sand becomes cool he lets it fall and applies a fresh lot, so he continues until the pain is removed or the sand exhausted.

Sin autem nec venis incidendis quidquam profecerint, et calidi vaporis usus, quod quidem varo accidit, curantium spem fefellerit, ingravescente morbo, ad extremum remedium confugiunt, foedum illud quidem et quod referre pudeat, verum tamen, si hujus gentis medicos audias vel in gravissimis morbis certissimum. Mulierem ob guventutem firmitatemque corporis lectam sex vel plures vivi in locum haud procul a castris remotum deducunt; ibique omnes deinceps in illa libidinem explent. Tum mulier ad pedas surgere jubetur, quo facilius, id quod maribus excepit, effluere possit; quod in vase collectum agrotanti ebibendum praebent. Infandam sane potionem, cujus tamen vim salutiferam hujus regionis incolae plurimis exemplis demonstratam esse confirmant. Equidem ipse in pluribus periculum factum esse comperi, sed ne in uno quidem languentis corporis viresfuisseredintegratas. Ceterum haud provsus incredibile videtur liquorem, qui vitæe communicandae enservit, eundem vi quadam vitali esse praeditum; ideoque fieri potest, ut quemadmodum ipsi uno ore testantur, homines ex illo haustu haud quidem morbo liberentur, sed in morbus excesserit, vires mali dituonitate affliatas denuo recipiant. Sed quoniam in hugus modi quœstionibus plane hospes sum, artis mediiae peritis rem dijudicandam relinquo.

In the treatment of snake-bites they are singularly successful. In my long experience of the aborigines I only know of one death resulting from that cause, although I have been cognizant of many aborigines being bitten from time to time. Their method of extracting the poison, though primitive, is most effectual. The

moment an aborigine is bitten, he squats down and pinches the bitten part between his thumb-nails. This causes the blood to exude from the fang punctures, which is rubbed off every now and then as it gathers. During this pinching part of the operation, his *murtoomoo* (wife) or companion, as the case may be, has not been idle. A small fire has been made, and a piece of of opossum skin heated thereat, to as high a temperature as the material will bear without shrivelling. When the blood ceases to flow from the pinchings, the heated skin is placed on the fang marks and kept there firmly by the palm of the hand; when the skin gets slightly cool it is removed, and the punctures sucked until the skin is reheated, when the sucking ceases, and the hot skin is again applied, and so the cure progresses, alternate sucking and the hot opossum skin applications until the patient is deemed out of danger. The whole operation seldom lasts more than three-quarters of an hour.

A sting from a deaf adder, however, is considered by the natives hopelessly fatal, therefore they rarely attempt the extraction of the deadly virus injected by that reptile's horny tail spur, in fact, they have not any time to try a cure, for the victim seldom lives twenty minutes after being wounded. These reptiles are the most dreaded of all the snake kind by the aborigines, by reason of their superior virulency. To add to the danger arising from these reptiles, nothing will move them from the position in which they are met. If one is touched by a careless foot, or even by a piece of stick, as he lies in the path, he does not crawl away from the interrupting object as quickly as possible, as is the habit of most other reptiles; no indeed, he merely raises his head and tail simultaneously, and with the rapidity of thought, seizes the disturbing object with his mouth, holding firmly thereby, whilst he drives his tail spur into it repeatedly.

I once saw a native bitten by a black snake; the punctures were on the shin a little above the ancle; it occurred whilst we were shooting ducks on a Murray lagoon. On being bitten, the first thing the blackfellow did was to kill the snake, he then squatted on the ground and pinched the fang punctures very hard; the blood as a matter of course under this treatment oozed from the wounds pretty freely, and as long as the faintest trace of blood came so long did the pinching continue; however, the whole proceedings did not occupy more than ten minutes. When the aborigine got up he said it was all right, and there was an end of the matter.

On another occasion, I knew of a native being struck on the great toe, also by a black snake. He was walking from the fishing ground to the camp after sunset when it happened, and as he had still 2 miles to go after the accident the poison had ample time to get into the circulation. As a matter of course, in this case the poison could not be pinched out, because the punctures were

in the horny* part of the toe, where pinching would not be of any avail. On reaching the camp, however, he was attended to at once; but the poison had been too long in the system to allow of a perfect cure; certainly his life was saved, but he could not move out of the camp without assistance for two years afterwards, and during these years of enforced confinement he was continually breaking out in boils and blotches, which in every instance left very uncurable ulcers and sores behind. All the sole of the bitten foot suppurated and came away piecemeal, leaving the bones and tendons of the foot quite bare. He never regained his wonted strength, or even a semblance of it; although he got to be able to walk about a little, it was quite an effort to do so. He wasted and dwindled quietly away, free from pain, for a few years more, when he died. At the time of his death, he was the merest skeleton I ever saw, and so light he could easily have been raised from the ground by one hand.

In their obstetrical practice they are very primitive indeed; but then, to be sure, scientific assistance is rarely required by them during the periods of parturition, their unconventional manner of living, together with the simplicity of dress, makes Dame Nature's assistance ample on nearly all those occasions. It does occur, occasionally, that a woman about to become a mother will be accompanied by one of her own sex into the part of the bush selected for the interesting event; but this is merely for company's sake, and not with the view of rendering assistance, as in all cases of the kind the mothers have their wits so well about them they even fasten the umbilical cord themselves. As soon as the dark mite of aboriginal humanity is brought forth, the mother picks it up and carries it straight to the nearest available water, where she washes it clean, and that, too, without taking the chill off the water. When this essential has been satisfactorily concluded, she rolls it up in her cloak, and walks off to the camp with the greatest composure; when she arrives there, neither her appearance, nor that of her new production, elicits the least wonder or surprise—the putative father even sits calmly by, and pays no particular heed. It frequently happens that a woman will be taken with the pains of labour during a trail from one place of encampment to another. When this occurs, she merely drops out of the line of march, and seeks the friendly shelter of some convenient bush, after which she picks up the trail again, and walks on to the new place of encampment, carrying her latest progeny with her as though the penalty incurred by Eve had not descended to her aboriginal sisterhood.

* The skin on the under part, as well as a good distance up the sides of the feet and toes of the aborigines, is as hard as a horse's hoof. This merely applies, as in fact, the whole of this paper does, to the unsophisticated aborigines.

During my long experience of the aborigines, I have only known of one parturition case terminating fatally, and, in my opinion, the woman was physically incapacitated for the ordeal of maternity—although it is such a simple matter from an aboriginal point of view—she being the veriest pigmy in the shape of a woman that I ever saw; besides, she gave birth to twins on the occasion, which may have had something to do with her death. Most singular to say, as far as I have been able to learn, this was the first and only instance of twins being born known to *these* aborigines, and these were by a white father.

Small-pox.

All the very old men in these tribes show distinct small-pox traces. In speaking of this scourge they say that it came with the waters, that is to say, it followed down the rivers in the early flood season, laying its death clutch on every tribe in its progress, until the whole country became perfectly decimated. During the earlier stages of its ravages the natives gave proper sepulture to its victims; but at last the death rate became so heavy, and, naturally, the panic so great, burying the bodies was no longer attempted—the survivors merely moved their camps daily, leaving the sick behind to die, unattended, and the dead to fester in the sun, or as food for wild dogs and carrion birds, until in a short time the whole atmosphere became tainted with the fetid odours arising from the decomposing bodies. The poor creatures began to think that not one would escape death, consequently they sank to so great a depth of despondency, through this foul destroyer, as to make them indifferent whether they lived or died.

When the bright torrid summer displaced the moister spring, the disease, after devastating these tribes, gradually died out, leaving but a sorry remnant of the aborigines behind, to mourn the depopulation of the land, and many, many moons waxed and waned before the fell destroyer's foul presence was even partially forgotten. To this day the old men who bear such patent traces of the loathed distemper speak shudderingly and with so much genuine horror as it is impossible for any other evil to elicit from their inherent stolidity.

This small-pox infliction seems to be the only occasion upon which great numbers died from one cause; it is not wonderful therefore if the survivors do look back to the time of the scourge with feelings of profound dread. The aborigines attributed this pestilence to the malign machinations of tribes away on the upper rivers, with whom they were not on terms of amity; that however is only a matter of course, since they ascribe all the ills with which nature smites them to the same source.

Food.

As a rule the food of these aborigines consists of fish principally, of which, for eight months in the year they have a superabundance; so much so indeed is their supply during those months they cannot nearly consume it all, consequently quite a moiety is absolutely wasted. To supplement the fish they have kangaroo, emu, opossum, and wallaby; and besides these, aquatic wild-fowl of countless variety are found in the greatest profusion on the lakes and lagoons; these latter they capture abundantly, aided by nets manufactured for that purpose only; and during the breeding season of these birds they get eggs innumerable, the canoes arriving at the camps in the evenings then are literally laden down to the water's edge with no other cargo but eggs; they are heaped up at both ends until there is hardly room for the native to stand and paddle. It is of but small moment to them whether the eggs have birds in them or not, as they are consumed with a relish all the same. A species of flag having a farinaceous root, called by the aborigines *kumpung*, grows very plentifully by the margins of all the lakes and lagoons; it makes, even to a European, a very palatable and nutritious food; it can be procured in abundance, but as it requires considerable labour to dig it, much less is procured than its manifold merits would justify. The flower-stem of this flag when it rises through the water in spring is also eaten in its raw green state; it is very insipid to European palates, and I fancy it contains but a very small modicum of nutritive matter; however the natives are extremely partial to it, they therefore consume it in great quantities. In this green stage the aborigines term it *jontie*. The common small-flowered yellow water lily which so plentifully fringes most of the colonial lakes and lagoons, is another source from whence they derive a desirable addition to their diet. The roots of this plant are formed of many tubers, averaging about an inch in length, by a diameter of about half an inch; the roots of one plant will frequently yield as many tubers as a half-pint measure will contain. They are baked before being eaten, and are of a sweet mawkish taste, and not unlike Jerusalem artichokes in their consistency. These tubers are called *laboor* by the aborigines.

The common sow thistle, dandelion, yam, and a trefoil which grows on country subject at times to inundations during their respective seasons are largely consumed. To see the *lyoors* (women) approaching the camp in the evenings with each a great bundle of these forage plants on her head, a stranger to their customs would imagine that they were providing the nightly fodder for a dairy of cows; they eat all these herbs in their raw state by way of salad.

Besides the foregoing they eat the larvæ of several kinds of ants, some of which are tree-inhabiting, whilst others are mound-raising ground insects. Grubs also of all kinds and sizes are greatly appreciated by them, more especially the large one common to the

gum-trees all over the Colony. The natives are very expert in discovering the shrubs and trees in which grubs are to be found, in fact they seldom err; yet to a casual observer, or even one with some acuteness, there is not the slightest perceptible difference in the appearance of a tree or shrub containing numerous grubs and those which do not contain any, but aboriginal observation is wonderfully keen in all matters pertaining to nature; even objects seemingly the most trivial fail to elude their ever ready perception. The ant larvæ is consumed raw, whilst the grubs are eaten either raw or roasted.

During the cold bleak weather which occurs in winter they are not the least bit choice as to their food; anything having life, no matter how repulsive to European notions it may be, is most acceptable at those times; frogs are deemed good; the then hybernating carpet or true snake most toothsome, and even the abominable fetid wild dog is esteemed a luxury of the very highest order.

Blackfellows' ovens or cooking-places have been a fertile source of argument for many years, some holding that they are not cooking-places at all, but tumuli or burrows left by some race long since passed away and quite forgotten. Still, so far as the general public are aware, none of the writers or discussers of the point have had sufficient curiosity to dig into the mounds, and so set the vexed question at rest once and for all.

Blackfellows' ovens are not by any means misnomers, as to all intents and purposes they are essentially genuine cooking-places, or cooking-places and kitchen middens combined, and the following is the manner of their formation:—A family, or perhaps several families, as the case may be, select a site for their camp, where abundance of game and other sources of food obtain and are procurable with the least expenditure of time and labour. Towards the middle of the afternoon the hunters drop into camp, with the result of the day's industry, consisting in all probability of all sorts and sizes; for my present purpose however I shall assume the game to consist of opossums only.

When the hunters have seated themselves comfortably, they set to work at once skinning the opossums, whilst several of the *lyoors* (women) go off with their yam-sticks; when they reach the spot selected for the purpose, they begin with a will to excavate a hole, about 3 feet in diameter and nearly 2 feet deep; during the digging of the hole any pieces of clay which they chip out, in size similar to ordinary road metal, are placed carefully on one side with the view to their future use.

When the hole has been dug sufficiently deep, it is swept or brushed out with some boughs or a bunch of grass; it is then filled to the top or a little above it with firewood, which the *lyoors* had previously collected and prepared for that purpose. On the top of the firewood the selected pieces of clay are carefully placed, the

wood is then ignited, and by the time it is all burned the clay nodules have become baked until they are exactly similar to irregular sections of well burnt brick; of course they are red hot. When this result has been properly achieved, the hot clay is removed from the hole; for this purpose they use two pieces of stick about 8 inches long, holding them both in one hand and working them deftly, even as a cookmaid uses a pair of tongs. The aborigines have not any distinctive name for these pieces of stick, merely calling them *kulkie* (wood).

The deft manipulation of these tongs is an accomplishment enjoyed by old and young alike; their dexterity therein seems quite an aboriginal gift, as few white men ever attain to any degree of proficiency in their use.

After the hot clay is removed from the hole the ashes are carefully swept out, and a thinnish layer of slightly moistened grass is placed over the bottom and round the sides, upon which the prepared opossums are nicely packed and covered over with more damp grass; the hot clay nodules are then spread evenly over the top of the grass, and over these the finer earth which originally came out of the excavation is spread.

Should this final covering be too thin to keep in the steam, it is supplemented by earth dug in immediate proximity (this supplemented soil fully accounts for the depressions always found about the bases of these ovens); ashes are never employed for the outside covering, nor is sand, because being so fine they would be apt to percolate through the interstices of both grass and clay nodules, thereby adding an amount of grit, which would not improve either the flavour or appearance of the food. Before the heat in the clay nodules and the hole itself has become exhausted the opossums are beautifully cooked, as perfectly so indeed as though the operation had been performed in the most perfect kitchen range extant.

When the cooking has been completed, the covering is scraped off, and this debris, consisting of calcined clay, ashes, and burnt earth, becomes the nucleus of a blackfellow's oven, such as are to be seen at the present day. This process being repeated at short intervals, over a series of years, perhaps indeed for centuries, results in the mounds which are in reality blacks' ovens.

As long as the camp remains in the same position the original hole is used for baking; and when it is understood that at least a barrowful of fresh clay is required every time the oven is heated, to replace the unavoidable waste by crumbling, which is by no means inconsiderable, in consequence of the clay being used in an unwrought state, it will readily be seen how these mounds gradually but surely increase; bones too of the animals they use as food, charcoal, &c., tend materially to hasten this growth.

As a general rule the aborigines do not erect their *loondthals* (huts) on these cooking mounds; an exception to this exists, however, on the extensive reedy plains of the lower rivers, which are annually inundated, remaining so for at least five months in the year.

On these wide-spreading reed-beds, blackfellows' ovens are much larger in size and vastly more numerous than they are in any other portion of the Colony, thus plainly denoting how dense the population in the locality must have been, as well as the abundance of food pertaining thereto, which was ready to hand for their sustenance. When the mild rains of spring dissolve the snows on the Alps and in their valleys, the liberated waters rush down the rivers and their innumerable tributaries, spreading themselves out in every direction, when they reach the reedy country, until many hundreds of square miles are submerged.

All over the submerged country, cooking mounds stand up out of the waters, perfect little islands, looking bright, green, and refreshing to the eye, by reason of the dense growth of giant salt-bush with which they are prettily dressed.

These oven islands the aborigines utilise in the flood season, for camp sites, conveying their firewood and other requirements over miles of water in their canoes. An encampment will frequently remain on one of these tiny islands for a whole month, the inhabitants thereof feasting to the top of their bent, on the oleaginous codfish and his congeners, taking ample toll from the great river-lobster, as well as from his more delicate though pigmy brother, the crawfish. Aquatic birds too, of many varieties, together with their eggs, have to contribute their share of the general spoil to the savage larder. It will thus be seen that everything used by the dwellers in these island encampments has to be brought there from outside places, and that the daily refuse therefrom aids very materially in the growth of these mounds.* So long as the fish and game continue plentiful the natives never think of moving to fresh quarters, that is to say, unless the tiny spot becomes too offensive for even aboriginal olfactories to bear with any degree of comfort. When it does so they shift away to another mound, leaving natural agencies to purify the contaminated atmosphere round and about the abandoned islet.

Aboriginal skeletons are frequently found in the cooking mounds, which no doubt led to the notion of their being barrows; the reason for the position of these skeletons, however, can easily be explained—for example, a death takes place on one of these

* These mounds are usually near to a permanent water (lake or lagoon) on these submerged plains, and as a matter of course were raised above the flood-level by long continued use before they become useful for encampment sites when the plains are inundated.

isolated spots, when there chances to be but a small section of a tribe located thereon, and as grave-digging is very arduous when hands are few and the implements merely yam-sticks, the easiest method, therefore, of covering up the dead from their sight is at once adopted, and that is simply enough done by scraping a hole in the friable soil of the mound, wherein the defunct is placed and covered up. Immediately after one of these hurried burials the mound is vacated, and ere much time has passed the defunct subject is entirely forgotten. Be it understood, however, that this description of sepulture is only given to old worn-out women or invalids of long standing, and who had become troublesome and tiresome to their unwilling attendants.

I once had occasion to remove the whole of a blackfellow's oven; it was a fair-sized one, and contained quite 3,000 cubic yards of soil; during its removal twenty-eight skeletons were exhumed. This large number was a matter of considerable surprise to me, but on making due inquiry amongst the very old aborigines—the young people of the tribe did not know anything about them—I discovered that they were the remains of some of the small-pox victims who died during the earlier stages of the epidemic, whilst sepulture was yet being given to those who succumbed to the loathsome plague.

Canoes.

The aborigines make their *unkooies* (canoes) from the bark of the red gum tree; bark of other trees, notably box, is also used, but merely for temporary purposes, as no other bark but the former will stand the weather without curling up and splitting. In all cases each canoe is made from a single sheet of bark without tie or join. In making these vessels, trees with natural curves are chosen, as canoes so obtained precludes the necessity of using fire to soften the bark with the view to giving the required rise stem and stern.

When the bark for a canoe is cut, stretchers are immediately placed across it at intervals of 3 feet; this is done to prevent the bark from curling whilst the sap is in it; short props are also placed under the stem and stern to keep them from becoming too much depressed by reason of their own weight. If at this stage the canoe should not have the exact shape desired by the maker, he places heavy billets of wood inside at those parts which require pressing outwards, and the bark being full of sap the pressure effects the end aimed at. After this, and whilst the weights are still in the canoe and the props still in position outside, a coat of well puddled clay is plastered all over the interior, which effectually hinders sun-cracks; in this condition the canoe is left in the sun to season. After ten or fifteen days' exposure the bark has become so hard that it is able to retain the shape ever after, no matter how

roughly it may be handled. It is therefore launched without the slightest ceremony upon the waters where it is destined to float for the few brief years of its existence.

After the lapse of two years or a little more the canoe becomes heavy and sodden, therefore correspondingly unwieldy, so the owner in his many rambles keeps his eyes about him with the view of discovering a suitable tree from which he can take a canoe wherewith to replace his now frail craft.

According to the size of the canoe required, so is the tree selected from which to take the bark. Heads of families generally have vessels large enough to move their whole households at once from place to place; bachelors however, having less impedimenta, usually content themselves with canoes of much less capacity, finding such more suited for pursuing aquatic birds during the moulting season, thousands of which they capture in their then most helpless condition; in harpooning fish too, the small canoe is found most manageable. The aborigines of this lacustrine and riverine area hold their canoes in higher estimation than they do any other of their possessions, but this is only a matter of course, for without these vessels their food would be very much more scanty than it is, and of a much poorer quality; besides, in the flood-time they would be unable to get about by reason of the many waters.

The stick for propelling (it can hardly be termed a paddle) is about 12 feet long, and 2 inches and a half in diameter; it is round; at one end it has three grains affixed, the centre one being half an inch shorter than the outer ones; the latter have a barb each just above the points, the centre one is smooth; the outer grains are made of wood hardened by fire, the centre one being of kangaroo bone; the pole is made of pine; the aboriginal name for the implement is *maroong*, that being the native name for pine tree. This instrument has a twofold use, that of propelling the canoe being one, and transfixing fish with the grains being the other.

When bent upon harpooning fish with this grained canoe stick, they select a stretch of shallow water, full of reeds and other aquatic vegetation, over which the wary fisherman quietly propels his canoe, using the plain end of the stick for the purpose; every now and then he jobs the stick sharply to the bottom in front of the canoe, thereby disturbing the feeding fish; as a matter of course they rush away from the neighbourhood of the disturbance, shaking the plants in their hurry; the movement of the plants above the water show the keen-eyed fisherman at once the position of his prey. After the plants have ceased shaking the wily savage pushes his canoe up gently to within striking distance of the plants which he saw last in motion, knowing quite well that at the foot thereof his game is resting; poising his grained weapon for but a short space, he launches it with wonderful precision, and seldom fails tc bring his scaly victim quivering and glittering into the upper air.

When sailing over deep water both ends of the stick are used; it is held by the middle at those times, and each end is dipped into the water alternately; they are wonderfully expert in the management of their canoes, driving them along with amazing velocity, and a directness of bearing truly splendid.

FIBRE PLANTS AND THEIR MANIPULATION.

Of fibre plants there are three which the aborigines utilise in the manufacture of twine and cord. The *Kampung (Typha mullora)* root furnishes the fibre most commonly employed in making the thread which is used for netting browbands, waistbelts, and bags of all sorts and sizes. The largest *mokoor mokoors* (bags) are used for transporting their multifarious belongings from one camp to another, whilst the smaller ones take the place of the pockets of civilization. Each male is provided with one of the latter, which is carried over the point of the shoulder or round the neck, as the fancy of the wearer inclines. This fibre is prepared for use after a very simple though primitive fashion, thus: After the root is baked (it produces food as well as fibre), it is not cut up into short sections for convenience in eating, as doing so would render the material comparatively worthless, by reason of its shortness; therefore each root is taken separately, the skin peeled off, and the remainder, which consists of farina and fibre, is twisted up into a knot, oftentimes as large as a good-sized fist; in this condition it is crammed into the mouths agape for its reception. Sometimes both hands are ludicrously employed in the performance of this feat. When one of these immense mouthfuls has been sufficiently masticated to extract all the farina, the residuum, which is the fibre, is ejected in the shape of a small knot of beautiful whitish tow. These knots of tow are carefully packed away in bags as they are formed, said bags being utilised for pillows until the time comes round for twine-making. When about to make twine, these tow knots are steeped in water for a night, which effectually softens any starchy matter they may contain. They are then teased out and well scraped with mussel shells, until they are perfectly cleansed; the clean flax is then tied up in small neat hanks, ready for the twine-maker's operations.

Considering that these aborigines do not possess any appliances other than those furnished by Dame Nature, it is truly wonderful how deft they are in the fabrication of cord and twine. They make these of sizes varying from those of a thickness equal to our clothes-lines down to the veriest tiny twine. Whatever the size may be, the cord or twine in *all* cases consists of two plies only, and the most singular thing about it is, that both strands or plies are twisted at one time, and as the hand is drawn back from twisting them, the retrograde action twines them together into the

finished cord. The work is done on the bare thigh, thus: Two flat hanks are loosened out, the ends of which are held by the left hand, the rest is laid straight across the thigh and kept apart by one of the fingers of the hand holding the ends; the palm of the right hand is now moistened and placed over the flax on the thigh, when it is rubbed sharply towards the knee. By this action, both of the flax hanks are twisted into firm threads, the finger which had kept the hanks apart is now withdrawn, and the right hand is pulled back with a sharp jerk, which results in the two threads being beautifully twined together into a neat cord. The end of the shortest hank (they always commence with a long and short hank) is now teased out, and the end of another hank is mixed with it, the two rubbing actions being again performed with a like result, so it continues, two rubs and a join alternately.

This process they will continue hour after hour, until the thigh becomes quite painful to the slightest touch; the thread-making is therefore thrown aside until the tender limb returns to its normal condition.

Boongoor, a fibre rush, is another plant from which they procure flax. This plant grows at the bases of sandhills, but not so low down as to impinge on the flooded ground on which the sandhills usually abut, but still near enough thereto to receive the benefit of the water by capillary attraction. As it grows, this rush is a rigid, harsh-looking plant, without the flexibility common to rushes which grow in moist situations.

In preparing fibre from this plant, they cut it as close to the ground as possible, so that the flax may be of a fairish length; it is then tied into bundles 6 inches in diameter, after which it is soaked in water for two days. When the soaking has been properly effected, it is placed in an oven and baked for four hours—it is then in a fit condition for the next process, which is scraping. The scraping is done with the view of removing the husk and pithy matter; the instruments used in this operation are mussel shells. Whilst the scraping is in progress the rushes are continually being dipped into water, the softening properties of which aid materially in the proper cleansing of the flax. When it is quite finished it is laid on the grass to dry, which it soon does, as it is spread out in small parcels, each parcel being merely sufficient to form one of the neat hanks of the correct size required in the manufacture of the cord or twine they may have in view. When dry, it is made up into the hanks and stored away until required, From this fibre, nets and fishing-lines are made, as also nets for taking ducks. It makes a most serviceable thread for either nets or fishing-lines, having the power to resist the rotting influence of water to a very great extent indeed.

The next and last of their cord-making plants is the giant-mallow; the fibre from this plant is of a much coarser texture

than those already described, therefore it is only used for making very thick coarse cord, which is worked up into nets for capturing emus.

The process of separating this fibre from the plant is the same as that adopted in the manipulation of the rush, with this one difference, after the mallow stems are taken out of the oven, they are well bruised with mallets, before they are dipped and scraped.

The emu nets made from this mallow fibre are frequently 150 yards long, the mesh being 6 inches wide. When completed, an emu net looks exactly similar to our sheep nets and quite as strong.

Enmeshing Emus.

The locality of a drove of emus is noted, and such natural features as the country in the vicinity presents, such as the near convergence of a lake and lagoon, or a river and a lagoon, are utilised for side or guiding lines to the net, the latter being fixed at the narrowest point of convergence; as a matter of course, in all cases, the ground between the lines at the point selected for fixing the net must be narrow enough to be spanned thereby. The net is firmly fixed by means of good stout stakes, well driven into the ground. When all is in readiness, several of the elderly aborigines *limpen* (hide) in the long grass at each end of the net, whilst the younger members of the tribe stretch themselves out in two long lines, having the form of a V, with the apex cut off, the narrow opening of this mutilated V fitting on to the natural converging lines. Previous to these lines being formed, scouts warily taking advantage of all the inequalities offered by bank or rise, stealthily creep round the unsuspecting emus; when their purpose has been achieved, they await quietly in ambush, for the preconcerted signal to startle the game towards the net prepared for their reception.

The signal being given, the scouts rise from their concealment, and with shout and gesture so frighten the gigantic birds that they start away with the velocity of a locomotive engine, the thuds from their great feet as they run almost making the very ground to tremble. If it so happens that the birds take off in the desired direction no word is spoken, the scouts merely keep following them up as fast as possible. If, however, the game should swerve from the right line, then those whose side line they are approaching show themselves, and if that should not turn them, then shouting and gesticulating are resorted to, which in most cases have the desired effect; sometimes though the effect is greater than was desired, in this case, the young men forming the other side line show themselves, whilst now the panting scouts coming up behind make as much noise as their labouring lungs will allow them.

When the birds have got within the water lines, the whole force in the field, with the exception of those lying in wait at the net, rush madly on, with the din of a pack of demons let loose, which induces the emus to put their best feet first, and so they run blindly into the net, when the old savages waiting to that end rush forward with a joy only known to savages, and club the poor enmeshed birds. It is but seldom that any escape out of the toils to warn their fellow emus of the fate to which they are all liable if due care and unwearied watchfulness be not continually exercised. As many as a dozen emus are frequently taken at one time in this manner, when of course there is nothing but feasting thought of in the camp for many succeeding days, or indeed as long as their supply lasts, or till it becomes putrid, which is not by any means an uncommon result after successful hunting expeditions.

Of Nets:

Their construction, and methods of application. Weirs how contrived, and of what utility.

Duck nets are usually 100 yards long, by 2 yards deep. In making these nets, the aborigines do not use a gauge, as is usual with Europeans—they simply judge of the size by the finger and thumb; the knot however is precisely similar to that made by European net-makers, the meshes are as regular in size as though a gauge had been employed, and the finished net is as uniform throughout its length and quite as strong as those made by men whose sole occupation is that of net-making. Fishing-nets are about the same length usually as those for catching ducks, but they are not so deep, being only 4 feet wide; the mesh is also different, being 3 inches wide, whilst the former is 4 inches. The same sized twine is used for making both nets.

Nets for taking crawfish are only 10 feet long, with a width of 2 yards, the mesh being only a quarter of an inch wide. These crawfish nets are made by the women only, it being deemed beneath the dignity of aboriginal manhood to make nets for catching such insignificant game as *Yappie* (crawfish). The women also net all the bags, waist-belts, brow-bands, &c., no matter whether they are to be worn by the nobler sex or not. The long nets, however, are made entirely by the men, with the exception of the flax preparation, that part of the business being generally performed by the women.

When a duck-trapping expedition has been arranged, all in the camp—men, women, and children—get in motion early in the morning and start off to the lagoon which has been selected for the scene of their operations.

On their arrival at, or rather near the lagoon, the women make a sort of impromptu camp, where they, together with the children

remain, for the twofold purpose of being out of the way, and to make fires at which to cook some of the game they are about to take.

Four of the old men then go off with the net to the point on the lagoon where they purpose fixing it. It is here stretched across, and close enough to the water to hinder the ducks from escaping underneath. In the meantime, the young active men of the tribe range themselves at regular intervals along both sides of the lagoon, high up amongst the branches of the trees with which the margin is fringed, each one having a light disk of bark, 6 or 7 inches in diameter, ready to launch at the birds as required. When they are all properly placed, one who has been sent off for that purpose startles the ducks. As is natural with these birds, the moment they are put to flight, they fly off along the course of the lagoon, following its sinuosities very closely. Should it chance, however, as it frequently does at those times, that the birds wish to leave that lagoon for another in the vicinity, one of the aborigines in the trees nearest to the point from which they wish to break whistles like a hawk, and hurls his disc of bark into the air. The ducks, hearing the whistle, look sharply about, and seeing the whirling disc, fancy it a hawk; consequently a simultaneous stoop is made down close to the surface of the water to escape their fancied enemy; then they continue along the course of the lagoon, the whirling disc and the shrill whistle of the native having materially accelerated their flight. When this panic has subsided and they again begin to soar, another whistle, with the accompaniment of a gyrating disc, soon brings them to the desired level, and thus the sport continues until, after having run this exciting gauntlet, the poor birds find themselves suddenly enveloped in the folds of the treacherous net, when the four guardians thereof, with the assistance of as many hands as can be in at the finish, take but a short space of time to secure the flapping prey, amid an abundance of pleasurable ejaculations and much tongue clucking from the women and children, who gloat over the fat, plump birds as they are drawn from the net. Hundreds and hundreds of ducks are captured in this manner during the months when the waters are confined to the rivers' beds. Of course when all the reedy plains are inundated the ducks have too much scope to be taken so readily; besides, when the waters are out, the ducks are engaged brooding, or in guarding and feeding their young.

The fishing-net is made use of in two ways; the first and common method is what civilised fisherman term hauling. It is conducted in the following fashion:—

A lagoon known to abound in fish, and perhaps not more than waist deep, is chosen as the scene of their operations.

When the aborigines have arrived at the chosen spot, those who are about to work the net tie pieces of calcined clay, weighing

about a pound and a half each, at intervals of 4 feet, all along the bottom line of the net, these pieces of clay having been brought by the women from the nearest cooking mound for that purpose. On the upper line of the net they fix small bundles of reeds at every 6 feet throughout its length; these reed bundles, as a matter of course, act as floats. Thus prepared the net is ready for work. One man now stands on the edge of the lagoon, holding one end of the net, whilst another holding the opposite end in his hand, and the greater bulk of it in his arms as well, stalks very quietly into the water, describing a considerable semicircle in his progress, paying out the net as he goes along. When the net has been nearly all let out, he comes back to the bank from whence he set out, about thirty paces from his companion, then the work of hauling begins in earnest. During this operation, those holding the ends of the nets gradually converge until within 2 yards of each other. Should the haul be a successful one, all the available muscle in the shape of women and even children too is called into requisition, and much clucking of the tongue ensues, as the bellying of the net becomes more and more perceptible, denoting the finny multitude enclosed within its meshes; the hauling and tugging however, goes on all the time, until at last, with one prodigious and final tug, the glittering denizens of the lagoon are triumphantly landed on the grassy margin in one struggling mass of dazzling glitter. On many occasions I have seen three, and four hundred-weight of fish drawn from lagoons at single hauls, consisting of cod, perch, catfish, blackfish, and turtle. It is quite a sight to see them all tumbling and jumping about on the grass, codfish from 50 pounds downwards, and perch, both gold and silver, from 10 pounds down to 2 pounds; the large mesh of the net prevents the landing of small fish, unless on very rare occasions.

When it does happen, however, that some few small fish are landed, the aborigines do not take the trouble to throw them into the water again, and as they disdain to be bothered with small fry in the fish season they are left on the bank for the delectation of crows and gulls.

As soon as the result of a good haul has been examined, the men pick up their spears &c., and stalk off to the camp in a most majestic manner, leaving the women and children to bring on the heavy wet net and the spoil thereof. In due time the women and children straggle into the camp by twos and threes, groaning and whining under their respective burdens.

When a small assemblage, such as two or three families, happen to be encamped in near proximity to a lake, they fix a net in zig-zag lines about 20 yards from the shore, or perhaps a little further out than that should the lake be a shallow one, and from this net daily supplies of fish are drawn, consisting principally of perch and catfish; occasionally a monster codfish is enmeshed, when

of course the net suffers considerably, and in most instances with the loss of the fish. An accident of this kind gives rise to much aboriginal language of, to put it in the mildest form, a demonstrative description, as it entails the labour of taking up the net for repairs, which otherwise would in all probability not be moved for a month or more. Nets so staked are visited morning and evening, and on each occasion from eight to a dozen fish are taken, varying in size from a minimum of 2 up to 10 pounds in weight.

Where the lower rivers run through the reedy country, the banks thereof are 3 or more feet higher than the plains behind them. These elevations look almost like artificial dykes, so perfect are they in their regularity. At irregular intervals all along these dykes, no one of the intervals being greater than a mile and a half, there are openings or creeks, 7 or 8 feet wide, and as deep as the country behind. Through these openings, when the rivers are in flood, the waters rush out, inundating many hundreds of square miles, and this country remains so submerged from August till January.

Whilst the waters thus cover the reedy plains, the various kinds of fish find delectable feeding grounds in the semi-tepid shallows, and the aboriginal fishermen, as a natural consequence, have abundance of sport and profit, too, in pursuing the finny game. Then it is that the canoe and grained paddle are utilised to perfection.

When the rivers begin to fall, the waters of the reedy plains find their way back to their parent streams, by the creeks in the dykes, and, naturally, the fish follow the receding waters. The wily aborigines, wise in their generation, when they see that the waters have decidedly begun to fall, prepare a lot of stoutish stakes, with which they form weirs across the dyke creeks. These stakes are driven firmly into the ground, about an inch apart, so that anything having a greater bulk than an inch aperture will allow to pass must perforce remain on the landward sides or the weirs. Without any great stretch of imagination one can easily fancy the shoals of fish which are held captive behind the weirs, and what a very simple matter the taking of them must be. When fish are required, an aboriginal takes his canoe into the midst of one of these shoals, and with his grained canoe pole harpoons as many as he wishes, or until he becomes tired of the fun.

The waters continue to run through the dyke creeks for five or six weeks, and during all that time the aborigines slay and feast as only savages can, and are therefore sleek and glossy, by reason of the vast quantity of adipose matter which they devour in these times of abundance. When the waters have all receded from the reedy plains, behind every weir fish of all kinds and sizes are left in thousands to rot and fester in the sun, or to be devoured

by crows or other carrion-feeding creatures, which are attracted to these points in countless numbers; but, notwithstanding their combined and loathsome efforts, the atmosphere round about becomes most pestilential in the extreme, and, consequently, to be decidedly avoided by those possessing anything like sensitive olfactories.

Had the aborigines the very least foresight during the fish season, they might cure sufficient food to supply their requirements through the dreary months of winter, in portions of which game is not over-abundant, and hunting then, too, is most toilsome. Native salt abounds in this area; it is therefore improvidence alone which prevents them from making the necessary provision. Ignorance of the preserving properties of salt, ere the advent of Europeans, might be very well brought in as a plea by them for not making due provision in anticipation of hard and hungry seasons. Since their intercourse with white men, however, that excuse is no longer tenable; still for all that, their improvident habits continue to obtain.

The *lyoors* (women) scratch or scrape the lagoons for the delicious little crawfish which they catch by the pailful. These delicate little shellfish are highly esteemed by the aborigines because of their piquant flavour, which I imagine to be entirely due to the fact of their eating them without other preparation than the removal of the shell. These little creatures being so much in request, the *lyoors* devote a considerable portion of their time catching them. They prepare the net for this purpose by tying a hoop round its bottom edge and the two ends, which gives it the appearance of half an oval; the top of the net is 8 feet long. It is worked by two *lyoors*, each having a bag hung round the neck to receive the result of their labours. They go into the shallow lagoons, one at each end of the net, and scrape it along the bottom; they perform the operation very quietly, as very little disturbance indeed would send all the crawfish in the immediate vicinity into their hole, which of course would render their labours nugatory. They do not take the net to the bank to empty it, they merely raise it gently from the water and remove whatever spoil it may contain to the bags suspended from their respective necks, and so they continue until they have captured as many as they deem sufficient. An hour's scraping frequently results in as many of these delectable crustaceæ as will fill a 6-gallon measure. It is only during the warm weather that these little crawfish can be taken by scraping the lagoons; in the cold weather they are all in their holes, so that when a noble (?) savage has a longing for a meal of these favourite shellfish whilst they are hybernating, his poor drudge of a wife has to turn out in the cold to procure the delicacy for him by groping with her hands down the holes of the little creatures; and as the entrances to the holes

are all under water, it is a cold and tedious undertaking to capture a dish of them sufficient for a meal worthy to be set before her lord.

They also have a net very nearly as fine in its texture as coarse gauze, with which, shortly after the spawning season, they take millions of young fry, many of them being less than an inch long; besides these, at the same time, they catch immense numbers of young lobsters and prawns, all of which are mixed up together and put into the pot as they are taken from the net, tadpoles and all, of which latter there are dozens taken every haul. This dish is esteemed a luxury of the highest order by the aboriginal epicure.

The aboriginal pot for cooking this collection of fry is made from an elbow or large root of a tree; it is scooped out until it becomes a mere shell of wood—*coolaman* is the aboriginal name for this vessel. When a lot of this fry has to be cooked, a quantity of red hot coals are prepared, over which is placed a layer of cold ashes sufficiently thick to cover the coals; the *coolaman* is then set on the top of this hot bed and filled with fry to its utmost capacity, the fry is well pressed down, so that but little water is required to fill up the interstices. After a considerable expenditure of aboriginal patience the water in the wooden pot becomes warm enough to turn the shrimps red, when of course the mess is cooked. During the whole process the water never actually boils, the faintest simmer being the nearest approach to the boiling point which it attains.

When cooked, this mess looks altogether so disgusting that I never had the temerity to taste of it, although I have eaten most kinds of aboriginal food, and frequently with enjoyment.

Games.

In the matter of sports, games, and pastimes, the aborigines have not any great diversity, but such as they have they enjoy to the very utmost; indeed they frequently continue some of their games until fatigue culminates in exhaustion. If they only displayed one half the zeal in procuring and conserving food for consumption during the cold wet months of winter that their various games call forth, there would not be a tithe of the misery in their midst that now prevails, and which is principally due to the many privations of that inclement season. The preparation and conservation of food for hard times should be a duty of the highest moment to them, but such being deemed an irksome task it is consequently distasteful, whereas playing games, however hard they may work in doing so, is merely recreation, and not at all incumbent; play is therefore held in high esteem and enjoyed accordingly.

During summer, when food of all kinds is abundant and procurable with little labour, the friendly tribes have great gatherings, at which wrestlings and other games constitute the business of the season.

The aborigines are great wrestlers, and enter into the exercise with every zest; their method is different from that which obtains in the wrestling counties of England, or, as far as I know, in any other country where the exercise is indulged. Their system is as follows:—A stalwart aborigine goes out quietly from the camp to the ground which has been carefully prepared for the games; he is perfectly nude, with the exception of his waist-belt and opossum skin armlets; when he reaches the arena he walks round it after the fashion of a race-horse getting his preliminary canter; during this walk or march there is abundant opportunity for examining his finely developed figure, the muscles down the back stand out as distinctly and hard as though they had been fashioned from straight, clean saplings, whilst his limbs, though somewhat lacking size, look hard and firm as ropes stretched to their fullest tension.

When he has satisfied himself as to the arena he stalks majestically into its centre, gives one defiant shout, and stoops forward, places his hands on his thighs, just above the knees, and in that position remains perfectly still, as though he were merely a bronze statue, instead of a muscular savage full of life, with the excited blood coursing exultantly through his throbbing veins.

His patience is not tested very severely, however, as his defiant challenge has scarcely died away when an equally muscular competitor starts out from the camp at a smart run, which he continues until within about two yards of his challenger, when he stops as suddenly as though his progress had been stayed by a bullet. His position when he thus suddenly halts is precisely similar to that of his adversary; for a few moments they remain in this stationary attitude, then they begin to sway from side to side, glaring at each other the while, as though they were veritable enemies about to begin a conflict which could only terminate in the death of one or both. All at once, without any signal, they make a simultaneous spring at each other, coiling their sinewy arms and legs round each, as opportunity offers, endeavouring by every ruse to gain the first advantage in the struggle. When locked together in the struggle they twist and screw their oily bodies into all sorts of contortions, raising each other from the ground as opportunity offers by sheer force of muscle; the raised one, however, generally managing to get his legs firmly twisted round the body of his friendly competitor, and when in that position no powers of muscle, however well exerted, will put him to the ground; that is to say, unless his antagonist goes with him, and then, of course, it is a drawn match, and a result of this kind is always avoided if possible, as defeat even is not greeted with greater derision than is a climax of this nature.

The struggle continues with apparently very equal success for a considerable time, neither gaining any material advantage. A

casual observer would be inclined to think it an interminable affair, but this idea would only be of limited duration, for as the struggle advances the wind of one begins to fail more rapidly than that of the other; the end then soon becomes apparent, the winded one is raised from the ground for the last time; he is not quick enough to grapple his wearied legs round his opponent, so with a huge and final effort he is flung into the air, coming down with a thud of sufficient force to shake the very ground.

The victor walks quietly to a little distance and squats himself down in silence; the spectators, however, are more demonstrative; the sleeping echoes, therefore, are roused with exultant shouts.

After a fairish interval has elapsed the victor, nothing loth, shakes himself once more together, gives his waist-belt an extra twist, walks into the arena and round it as before, only in this instance he gesticulates violently whilst challenging any other man to meet him in the wrestle, letting it be well known all the time that if any man has the temerity to attempt his proved prowess, it will not be by any means beneficial to that man's physical welfare. With this flourish he again pauses in the middle of the arena, with his hands on his thighs as before.

And so the fun goes on, the victor meeting rival after rival, until he disposes of all who are courageous enough to try conclusions with him, or he himself is brought to grief by some one abler or fresher.

These muscular encounters generally end in many bruises, and not unfrequently collar-bones are broken and shoulder-joints dislocated; still, these mishaps do not deter them from repetitions of the play whenever opportunity offers, said opportunities merely depending on a goodly muster of aborigines, warm weather, and abundance of easily procured food.

Ball-playing is another game to which they are exceedingly partial. This game they make much more boisterous and noisy than they do the wrestling bouts, but, notwithstanding this, it results in very much fewer serious mishaps. The women participate in this game as well as the men. I have seen as many as 200 (including both sexes) engaged in this game at one time.

The ball is composed of old opossum skin tightly rolled up, and covered with a fresh piece of skin firmly sewed together with opossum tail sinews; before they begin to play they arrange sides, each side having a captain, whose place it is to guide and control his oftentimes unruly squad.

When all is in order, a *lyoor* starts off with the ball in her hand; she walks a little way out from her own side and towards that of her opponents, drops the ball with seeming carelessness, but ere it has time to reach the ground she gives a dexterous and by no means a gentle kick, which being correctly aimed sends the ball

spinning high into the air. Thereupon the fun begins in downright earnest. Such screaming, jumping, and frothing at the mouth by reason of the excitement I am certain was never seen at any other game outside the walls of Bedlam, and then again, such intermingling of limbs, brawny and bronze, nude and glossy, or such *outré* groupings were never yet beheld under any circumstances other than those attendant upon an aboriginal ball match. They have not any appointed goal to which the ball has to be driven; the whole of the play merely consists of keeping the ball in motion, and preventing its coming to the ground, whilst the struggles of the game all tend to keep the ball from being captured by the opposing side.

Those holding the ball throw it from one to the other of their own side, and it is whilst this is going on that the non-possessors strenuously run and jump to intercept it in its flights. As the eyes of the players are never by any chance bent on the ground, tumbles during a game are numerous and frequently ludicrous, more especially when one goes down, and so becomes a stumbling-block over which a dozen or more come toppling in a heap; these incidents, however, add mirth unto the fun, without creating the least ill temper.

Ball-playing is frequently kept up from noon until dark, and even at that late hour it is given up with reluctance.

The many laughable incidents which occur during the game provide ample matter for conversation round the camp fire, besides affording abundant opportunity for high fecondé to which they are particularly addicted, both old and young—in fact it is a trait peculiarly characteristic of these people.

Another of their games at which they spend considerable time is *Wotchwie*, that being both the name of the game and the toy with which it is played.

The toy is made of an elongated (not exactly oval) piece of wood, its extreme length being 5 inches, and its greatest diameter an inch and a half from the centre, which is the thickest part; it is fined down to a point at each end; to one of the ends a slender wand two feet and a half long, which had been previously toughened by fire, is firmly attached by means of twine and gum. So fixed, the toy is complete.

The game can be played by any number; both sexes, from eight years of age up to the *ngarumbin* (old man) and *galour* (old woman) join in it. When they start from the camp to commence the game, they select a stretch of three or four hundred yards of flat, smooth ground, at one end of which a mark is made by way of a startpoint. When all is properly completed the game begins after the following fashion :—

One takes a short run up to the starting mark, and when he reaches that he throws his *wotchwie* from him, so that it strikes

the ground in a particular manner, an awkward cast is certain to result in a broken toy, when the tiny thing bounds away with a velocity almost incredible, the long tail-like wand being visible all the time that the momentum continues, twirling and twining above the grass, more like a sentient creature than an inanimate toy. These toys frequently go quite 400 yards in their eccentric running bounds. The game consists merely in each striving to make his toy pass that of his fellow. As the breakages during the progress of a game are numerous, each player provides himself with several *wotchwies* before the game commences.

Doubtless this *wotchwie* racing seems a simple enough kind of pastime when thus described on paper, still I have seen as much excited enthusiasm engendered in watching the fluctuations of the tiny hoppers as e'er a rink of curling gave rise to on a well-frozen Scotch loch.

Spear-throwing also induces much good-natured rivalry. Whenever the tribal chivalry chance to meet for pastime, all the males, from those on the confines of puberty up to the hoary-headed sage, put forth their skill on those occasions, and proud is the victor who walks off triumphantly master of the field.

These matches are conducted as follows:—A thickish disc of red gum bark is prepared: it is about a foot in diameter, and being green is not easily split when struck by the spears. A stalwart youth walks off with the disc forty or fifty paces from where the competitors are drawn up in line. When he has arrived at the desired position, which is about 10 yards beyond the parallel of the end of the line, he pauses, then with the disc raised aloft in both hands, and at the word of command, he hurls it from him with all his force; the impetus thus given is sufficient to make it roll with no mean velocity from one end of the line of competitors to the other. It is during the rapid progression of the disc that the competitors launch their spears at it, each one doing so as it passes his line of vision. By the time the disc has ceased rolling, it presents the appearance of a gigantic shuttlecock, the spears sticking therein representing the feathers, and the bark the cork basis. When one makes a bull's-eye (as riflemen have it), he is greeted with loud applause, and it is most farcical to see how modest he endeavours to appear under the laudation, striving to make it appear but a common occurrence, therefore not worth making a noise about; although perhaps, if the truth were known, he never came even near doing such a thing before.

Another favourite amusement of theirs is the skipping-rope; not the tiny clothes-line affair with two handles of wood, so much affected by school girls; no, indeed, their skipping rope is 20 or more feet long. It is made of a duck net loosely twisted; it is worked by two young men one at each end, and just far enough apart to allow the sag to touch the ground. As it is being swung

round, the skippers jump in one after another, until there will be as many as a dozen skipping away at once. As they become tired they jump out, but the vacancies thus caused are always filled up as soon as made, by fresh muscle and wind, abundance of which, in the shape of stalwart young men and vigorous girls, who are both ready and willing to make a display of their agility, and merely await the longed-for opportunity.

Thus the rope is kept going, until those swinging it become tired, when they cease, and two fresh hands take their places; and so the fun continues, till they are all pretty well fatigued by the violent though pleasing exercise.

They do not award any trophies for superiority in their various games; even the historical "pickle parsley for their pains" is not given, therefore the victors have to content themselves with a consciousness of their superiority, and without doubt this sense of premiership lends considerable self-importance to the deportment of the successful ones during these tribal gatherings, as indeed I have frequently seen demonstrated, yes, even to the verge of the ludicrous.

Crime and its punishment.

Not having any Courts of justice, as a natural consequence the lawyer element does not obtain amongst these aborigines, nor do they possess any Judges or specially nominated patriarchs to whom disputed points can be referred; but notwithstanding all this, they manage to exist in a peaceable enough manner, in fact the paucity of disputes or rows is most wonderful considering the unrestricted method of their growth from childhood to maturity. They do not consider any offence criminal unless it be that of murder, and when such has been perpetrated, the whole tribe sits in judgment on the culprit; one of the old men, generally a friend of the murdered man, officiates as Crown Prosecutor after a mild sort of a fashion. In these cases, however, the legal acumen required under the circumstances is of the smallest; because, as a rule, the culprit never thinks for a moment of denying his culpability, so the tribe merely assemble to hear any extenuating plea which he may have to offer. Should the culprit's plea not be of any avail, and his crime be adjudged deserving of punishment, he is straightway condemned to stand up as a target, within easy spearing distance, and there to remain perfectly nude with only a simple shield to protect himself, for about twenty minutes, whilst the young men of the tribe essay their marksmanship. The dexterity usually displayed by such criminals in turning aside the spears which are hurled at them, by the aid of the shield alone, is truly marvellous, and in the most of such cases brings their persons through the trying ordeal in safety, with the exception perhaps of a few flesh wounds.

It is only when the ordeal is too long drawn out, and the dexter arm becomes fatigued in consequence, that a fatal result ever ensues.

The running of this gauntlet is of frequent occurrence, as will be readily understood when I say that about every sixth man has, some time or other killed a fellow.

When a culprit has passed through one of these trying ordeals he is received by his fellows as though he was as free from guilt as a new born babe, in fact, I am rather inclined to believe that he is held in higher estimation than ever, by reason of the dexterity which brought him so safely through the supreme trial. In the absence of Courts, lawyers, and other such civilizing institutions, gaols, or other contrivances for securing offenders, would be out of place, besides in their simple code of ethics there is not any crime sufficiently heinous to warrant confinement, unless it be that of murder, and in a murder case the trial takes place immediately on the discovery of the crime; in most instances of the kind too, the culprit voluntarily gives himself up to be judged.

During my long experience of the aboriginal tribes I can only cite one case of a murderer endeavouring to evade the penalty of his crime by flight, and most wonderful to relate his endeavour was in every way successful, for he contrived to ingratiate himself into the favourable notice of a tribe at feud with his own, and by whom he was so much thought of and admired, his adoption as a member of the tribe took place ere he had been many days amongst them, after which, of course, he was safe enough so far as any fear of his being given up to aboriginal justice was concerned.

This red-handed ruffian became the moving spirit in every mischief concocted against the stock and persons of those who took up country on the hunting grounds of his adopted tribe. Retributive justice however, overtook the vagabond in the end, the Victorian black troopers came over to New South Wales after him, he having inveigled one of the said troopers fellows away on a pretended fishing excursion, and when in the middle of a dense reed bed the pseudo fishing party threw the unsuspecting trooper to the ground, where they held him fast whilst the renegade excised the poor fellow's kidney fat. After the perpetration of this ruthless cruelty they started off in haste, leaving their mutilated victim to die in solitude mid the reeds; fortunately however, the butchered trooper had sufficient vitality remaining to enable him to crawl to the camp, although suffering the acutest agony, where, before he died, he gave an account of the murderous assault, together with a lucid description of the perpetrators.

But a short space of time elapsed after the recital of this diabolical outrage ere the aboriginal troopers had started on the trail of the murderers; they soon discovered where the vagabonds had crossed the river, and made but very small bones of crossing in

pursuit, horses, accoutrements and all, taking all sorts of care during the passage not to allow their ammunition to get wet.

A ride of about a dozen miles brought them to the camp they were in search of, and just as they were about to gallop into it one of the troopers descried the renegade creeping away through the tall saltbushes; pursuit was soon given by the whole troop, which, when the renegade perceived, he stood up from his crouching position and ran as only an aboriginal can run when dear life is the guerdon, but his running, swift as it was on this occasion, availed him but little, as the foremost trooper even although going at full gallop, took aim across his bridle arm, and so sent a bullet crashing through the skull of the dastardly savage. As he reeled to the earth the troop gave one shout of savage triumph as they rushed up pell mell to their now prostrate foe, where they threw themselves from their horses in a crowd, and with flashing sabres smote the carcass of the wily murderer until it was reduced to pieces not larger than a palm's breadth, deeming that proceeding—butchery though it was—but a fitting caution to all coveters of other people's kidney fat.

When a trial for murder has resulted in the condemnation of the criminal, the capital ordeal follows immediately on the passing of the sentence in the presence of all the assembled tribe, including both sexes. In fact, such occasions take the shape of high holiday spectacles, and as such are appreciated amazingly; criticisms are freely made, laudatory or the contrary, according as a well or ill-thrown cast is made; remarks too on the dexterous use of the shield by the culprit are openly interjected, culminating in a spontaneous shout of applause whenever a well-aimed spear is caught and smashed on the shield.

The most patriarchal aborigine in the tribe is selected to act as umpire on these occasions, and in the absence of time-pieces the ordeal is either lengthened or curtailed according to the interest that he takes in the proceedings. In general the ordeal lasts a good long twenty minutes, to which the culprit could doubtless readily testify; in most cases he is on the verge of fainting before he gets notice that his penalty has been duly paid. When this good news reaches his ears, he with much gladness throws himself prone where he had stood, panting and exhausted. Thereupon one of the softer sex belonging to him, wife, sister, or ward, goes up to the prostrate and quivering ordealist and forthwith proceeds to dry the fervid perspiration with which his wearied body is plentifully suffused, speaking such comforting words of praise to him the while as makes him almost forget the painful trial through which he has so successfully passed.

Meanwhile the spectators have all dispersed by twos and threes to their usual avocations, commenting noisily upon the bravery and expertness displayed by him who had so successfully undergone the supreme trial.

OF THE ABORIGINAL DOG, HOW UTILISED.—OF FLEAS AND OTHER NOXIOUS PARASITES.

The only animal these aborigines possess in a state of domesticity is the indigenous dog, *Canis familiaris Australis*, and of these quadrupeds they keep perfect packs. They are used for the running down of game, and although not particularly speedy, are found very useful in following wounded animals not sufficiently maimed to allow of their being easily overtaken by the hunters In the cold nights also these animals are of singularly good service, as they tend in no inconsiderable degree to keep up the temperature in the *loondthals*, where they sleep in common with their owners. This character of bedding is very much affected by the *galours* (old women), who in consequence value the dogs inordinately; so woe betide the man, either white or black, who should by chance or otherwise destroy a dog the property of a *galour*, for she would surely brain him if possible with her yam-stick.

I remember on one occasion in the old bye-gone days of the Colony, where a pack of these wretched curs pertaining to an aboriginal encampment, which was close to a shepherd's hut, playing the very mischief amongst a flock of fattening wethers. As a matter of course, I felt considerably irate thereat, and in very palpable terms made the aborigines aware of the fact. The men of the tribe saw and acknowledged the harm which had been done, and by way of making some kind of *amends* empowered me to poison the mangy brutes, at the same time giving me many cautions about the *galours*, lest during the distribution of the baits they should fall upon and maltreat me with their potent yam-sticks.

Having the terror of the yam-stick when wielded by irate *galours* brought thus vividly before me, ere making a start to the camp with the baits I provided myself with a gun for protection; not that I had any intention of using it on the angry old women, but I was perfectly well aware that such a weapon in the hands of a white man was more powerful to keep them in check than any other argument that could be adduced.

In due time I reached the camp, with forty baits. At a glance the old dames knew that the bag contained poison, so without more ado they immediately began to call their *wirrangins* (dogs) into the loondthals, thinking by that means to prevent me from having a chance to administer the baits, and when I told them that I had come for the express purpose of killing their dogs because of the havoc made by them amongst the sheep, they actually laughed me to scorn in concert. In trying to reason the point with them, they did not give me the ghost of a chance, their concerted volubility being greater than any one man could pretend to cope with, even although backed up by the possession of a gun. I was nearly beginning to look upon my errand as a very profitless one indeed, when old *Pinboceroo* crossed the lagoon, on which the camp was

situated, and stalked majestically into the middle of the billingsgating *galours*. His opportune arrival on the exciting scene was hailed by me with considerable pleasure, and the heated dark-skinned dames also seemed to think his presence a fortunate occurrence, as they one and all immediately began to pour forth their great grievance to him. He however soon brought matters to a very definite conclusion, by commanding the oldest *galour* present (poor old Nip Nip) to take the baits from me one at a time, and straightway give them to such dogs as I should point out. When the earnestness of what old king *Pinboceroo* said became apparent, the noise in the camp changed from angry vituperation to direful woe, in the midst of which, and not caring to refuse the old king, *Nip Nip* came meekly to me for the baits, which she administered as I desired. After concluding this very satisfactory piece of business, I left the camp, mid a perfect deluge of opprobrium. For many weeks after this poisoning episode, the *galour* portion of the tribe grieved abundantly mourning at morning and eventide, some of them indeed went to the extent of cauterising their wrinkled bodies in the plenitude of their sorrow. For many years afterwards, the canine massacre was vividly remembered by the *galour* mind, and even when bidding old *Nip Nip* a final good-bye, and whilst her rheumy eyes were welling over with genuine tears because of my departure, she could not help referring to the day of the dog-slaughter by the side of the lagoon.

In rough cold winter weather, which is the black spot of aboriginal life, when hunting is out of the question and food resources are of the smallest, these dingoes are converted into rations, and really, when well cooked in one of their ovens, these dishes of dog are tempting enough to look at, and I think there is small doubt about their tasting well, that is of course reasoning from the gusto with which the aborigines consume them; I, however, never had sufficient courage to partake of this dog meat, but I have seen plenty of it taken from the ovens, and it always looked white and delicate as chicken.

A puppy dingo, when in good condition, is esteemed quite a luxury, therefore an aboriginal having such a dish fancies that he is faring most sumptuously.

It is not by any means an uncommon thing for a *galour* to have as many as two dozen dogs, and it is certainly a rarity to find one possessing a lesser number than half-a-dozen; from this fact, it can easily be imagined the enormous dimensions which packs assume when all the members of a tribe are assembled in one camp.

In connection with these dogs and the habit the aborigines have of making bedfellows of them, there is one feature which I think both striking and peculiar, and that is this fact,—until the advent of Europeans these people had never seen or heard of

fleas, although of other kinds of parasites common to the filthy portion of civilization they possess legion. These latter have been a chronic source of annoyance to them, from the remotest period of which they have any knowledge, and although they have waged a continuous war against them, even from one generation to another, still the filthy pests have held their own.

With the exception of the hair on the face and head, the aborigines remove every vestige of a capillary nature from the body, even to the covering of the pudenda. The depilatory operation is effected by means of a small fire-stick, and is therefore both slow and disagreeable; this tedious and unpleasant process however, is borne without murmur, as it is done with the view of ridding themselves of the parasitic pests. Besides these measures, they manipulate each others' heads as it is said it is the habit of monkeys to do for a similar purpose, but notwithstanding all this, the poor aborigines continue persistently to scratch, which indubitably induces a creepy feeling of disgust to permeate the person of any cleanly inclined beholder. These indigenous parasites would be borne by the aborigines pretty well, as every successive singeing afforded some measure of respite; the fleas, however, are quite beyond their patience, respite from them there is not any, and they cannot lessen their numbers, do whatsoever they may to that end. Their numberless dogs provide the very best breeding-grounds, whilst their opossum cloaks offer them harbour which cannot be excelled.

Of the Sun, Moon, and some Planets.

The aborigines imagine the sun to be a large fire, kindled in the *tyrrily* (sky) by *Ngondenont* (their good spirit) daily, accounting for its origin in the following fashion:—In the long past and almost forgotten time, the only light which shone upon the world came from the *mitian* (moon) and *toorts* (stars) alone at that time; there were not any people on the *tungie* (earth), it being inhabited by beasts and birds only. One day during this period of semi-darkness, a *kurwie* (emu) and a *koortinie* (native companion) quarrelled very violently, and the latter whilst in the very height of her passion, threw one of the simple-minded *kurwie's* eggs up to the vast *tyrrily*, where it broke on a large pile of firewood, which *Ngondenont* had seemingly prepared to that end. The concussion produced spontaneous fire, and the whole world was incontinently flooded with light. *Ngondenont* immediately saw the great advantage that this light would be to the dwellers upon the earth, therefore, he thereupon vowed that the world would never more be left in continual darkness as it had been up to that time, for he would light the fire that seemed so good every day, and the vow then made by the good spirit has never been broken to the present time. They prove this quaint myth of theirs by pointing out that in the

early morning ere the fire is well kindled the *nowie* (sun) diffuses but little warmth; as the day advances however the heat becomes greater and greater until noon, when its fervency culminates; from that time the warmth gradually lessens as the fuel becomes more and more reduced, till the pile is completely burnt out and darkness covers the face of the *tungie*, when it is night. During the darkness however, *Ngondenont* has his attendant spirits employed preparing a fresh pile of wood for next day's consumption.

The *mitian* (moon) they imagine to be composed of some shiny substance, such as a large slice of *kalkoolban* (gypsum), and in order to prove that in this matter they are also correct, they hold that there is not the very slightest degree of warmth emanating therefrom, it merely glitters and shines coldly, and a large piece of *kalkooban* would do the same; indeed, they illustrate this theory of theirs by holding a piece of gypsum in the rays of the sun or within the influence of fire-light, and triumphantly ask what better proof could be desired.

According to their computation each moon lasts *polite kiup murnangin, nga polite kiup murnangin* (three hands and three hands) that is thirty fingers, in this case meaning nights. They compare the moon to an opossum cloak, after this fashion:—

When a native has a rug to make, he does not wait until he has acquired sufficient skins to complete it, for as soon as he has two or three skins he sews them together, and wears them mantilla fashion across his shoulders, going on day by day adding thereto, but wearing it all the same time until at last it becomes a finished cloak. Shortly after the completion of the cloak, or indeed frequently before that end has been attained, from the constant wear, as a matter of course it gradually begins to fray at the edges, more especially those skins which were worn mantilla wise at the beginning, until by continual use, like the moon, it is worn out, necessitating the commencement of a new one after the same manner.

According to the mythology of these people, *panmarootoortie* (the Pleiads) are composed of seven *mooroongoors* (virgins), being sisters who were translated to their present proud position in the sky because the whole of them, from the eldest even to the youngest born, retained their virgin purity until the advent of grey hairs.*

When *Ngondenont* with unqualified pleasure saw that these virgins had attained the meridian of life and still remained chaste, he deemed them far too good to associate longer with their dissolute tribe, therefore he forthwith translated them to the *tyrrily*, where he fixed them, in order that they might ever after be enabled to view the actions of their heretofore sisterhood, and

* It will thus be seen that, although their notions of chastity with regard to every-day life are of the very haziest, the author of this myth had glimmerings (to say the least of it) of better things.

so be ever ready to guide them straight should temptation induce any of them to swerve from the path of rectitude; besides, the *lyoors* could always see them by looking upwards, and would therefore be scarcely guilty of any gross indiscretion in the very faces of the *panmarootoortie* whose lives whilst on the *tungie* were without stain or reproach.

Boorongkootchal (Venus) is sent in the early morning by *Ngondenont* to let the *tungie* know that he is about to light up the glowing *nowie*, so that his *wartongies* (people) may prepare for their daily avocations. In the evening this planet is termed *Worka Worka*, at which time his fort is the well-being of gestation, whether of man or beast. Therefore gravid *lyoors* when they observe him bright and unclouded, looking calmly down on the *tungie* like a *panoo mitian* (small moon), imagine that their wishes, whatever they may be, with regard to their prospective offspring will be granted them. On the other hand, however, should *Worka Worka* be looked at when dimmed and diminished by reason of the intervention of a murky atmosphere, the fate of the unborn will be a fitful one, therefore expectant mothers are elated or depressed accordingly.

The aborigines do not possess any ceremonies or incantations wherewith to propitiate this birth-governing *Worka Worka*, even although they deem his influence all-powerful in making or marring the careers of the unborn.

Of the Seasons.

The aborigines divide the year as Europeans do, that is, into four seasons:—

Kurtie (Summer) is distinguished by a general display of flowers, and by their gradually changing into seed-vessels and fruit, and by the brown tints which the ripening grasses assume, together with the flight of all fledgelings, and the abandonment for good of the maternal pouch by the young kangaroo.

Weat (Autumn) is known by the cottony gossamer substance which floats about in the atmosphere during that period in this area, by the hybernating of snakes and other reptiles, which then seek out their quarters for their winter's repose.

Miangie (Winter) begins with the first *tenangin* (frost), and continues until the mild lengthening days of spring puts it to flight. There is but small chance of this season passing unnoticed, as the cold wet dreary days and nights thereof are frequently borne by the poor aborigines whilst in a state of semi-starvation as regards both food and warmth, therefore the first indication of spring makes them jubilant to a degree, as then the near approach of food in abundance and of all kinds seems tolerably tangible, and no longer mere visions of the brain induced by partaking of infrequent as well as insufficient meals of very indigestible food.

Bakroothakootoo (Spring) is defined by the advent of succulent herbage upon which the *ngarrow* (bustard) loves to graze, by the pairing of birds and consequent egg harvest, and by the emergence of the infant kangaroo from the parent pouch for the first time.*

They have no single term which includes all the seasons, such as our year.

MARKING TIME.

Their method of computing time is by *nowies* (suns or days, *mitians* (moons) and *kurties* (summers), but not having anything but oral words to depend upon, their data as may well be supposed is oftentimes far out in the point of time; the reliance therefore to be placed on any dates which they may give with regard to accuracy if even not more than a very few years back, can only be of the smallest.

COMPUTING NUMBERS.

After getting beyond twenty, or at most thirty in numbers, they become very hazy, and to get themselves out of the fog they say, *co co* (many) which may mean ten, or five hundred, or in fact any other quantity, and there are not any means short of actual investigation whereby it is possible to know whether the greater or lesser number is meant.

LACK OF COMPARISON.

The entire absence of this organ in the aboriginal cranium tends materially to the creation of the above difficulty, as, for example, ask an aboriginal which one of two flocks of ducks is the largest, and his reply will be *politula co co* (they are both large), and this reply will be given, or one similarly lucid, in every other matter of comparison which may come under observation, whether of numbers or quality, only in the latter case the noun *talko* (good) will be substituted for *co co*.

LAARP.

Laarp is the excrement of a small green beetle wherein the larva thereof is deposited. At certain times these insects congregate in myriads, and make their deposits on the young mallee scrub shoots which have sprung up after a previous season's bush fire.

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* The aborigines are not by any means bad observers of natural history, and they emphatically hold that marsupial generation is altogether distinct from that of any other genus of mammals; that there is not any period of parturition unless the *first* appearance of the young from the pouch can be termed such. Besides, they say that even if the kangaroo possessed the extremest delicacy of touch imaginable (which the great horny terminals to their paws clearly forbid), how would it be possible to place the inanimate embryo on the teat of a young doe that never had suckled a young one, when the opening of the marsupe is so *constricted* that the insertion of even the point of a pen-holder would be all but impossible, and the embryo is frequently found on the nipple when the pouch is so constricted; this fact indeed has come under my own observation on more occasions than one.

The deposits are made in such large quantities an aboriginal can easily gather 40 or 50 pounds weight of it in a day. As the aborigines are extremely fond of this sweet substance, during its season they do very little else but gather and consume it, and they thrive on it most amazingly. In appearance the *laarp* is not unlike the manna which some of the Eucalyptus genus shed in the summer months; the taste is also something similar, with the addition of a slightly acid flavour. These *laarp* deposits are made in the dry summer, and are procurable from their first appearance until the early autumn rains commence, when they are at once dissolved and washed away.

It frequently happens that the *laarp* deposits are 15 or 20 miles distant from water (the most arid spots in the mallee are those generally chosen by the insect, if the young mallee shoots be available); but notwithstanding the distance and the absence of water, every member of the tribe who can crawl at all, even including children, start off to the *laarp* field in the jolliest of spirits, carrying all manner of things wherein to pack the expected treasures. Seeing them in their high glee preparing to start on one of these expeditions is a most amusing sight, and conveys to the mind of the observer the impression that he is looking upon the happiest community of people in existence; there is however, another side to the picture, which is certainly the reverse of pleasing. Ere half a dozen miles have been travelled by the jolly *laarp* seekers, the frail and weak of the party begin to groan and moan as none but aboriginal human nature can; finally of course they knock up entirely, and so come to a stand-still; the strong ones however do not pay the least attention to these laggards, but continue in their course quite unconcerned.

The willing spirit of the weakly would-be searchers after this aboriginal sweet has to succumb to physical incapacity, therefore they have to sit down in their tracks, to recuperate their failing energies to enable them to return to the camp, from which when all too late they discovered they should not have started. The strong ones also, who had stepped out so valiantly at the start to the *laarp* field, present a very different appearance on their return; their high jubilant spirits have quite evaporated by reason of the thirsty toil experienced on their weary tramp, they consequently struggle back as moody and sulky as well could be, by ones, by twos, and threes; the units preponderating considerably, surliness not being conducive to social intercourse, and it is only after several hours of sulky rest, together with much gluttony, that they can be brought to describe the trip and the condition of the *laarp* field.

Notwithstanding the hardships and privations experienced on the first expedition, as soon as ever their aboriginal nature has recovered its normal tone, a fresh excursion is organized similar

to the preceding one, excepting only that the frail ones and the children remain behind on this occasion, delectating with much gusto on the fruits of the first expedition.

As long as the laarp is obtainable these people continue day after day to tramp backwards and forwards to the ground where it is produced, and it is only when the rains come and dissolve it that they leave and return to their usual avocations.

Should the *laarp* harvest extend over six or eight weeks, which it frequently does, the aborigines become quite fat and sleek, although they partake of very little other food all the time, thus demonstrating how very great the nutriment must be which this saccharine substance contains.

Poetry.

The poetical faculty is altogether lacking in the aboriginal character, consequently they do not possess any poems, either martial or national, and the entire absence of everything in the shape of sentiment, in the intercourse of the sexes, leaves the most fruitful of all poetical fields but a barren waste. Their *tchowies* (songs) to which they dance their corrobories never comprise more than two lines, and even those do not rhyme; the measure however is always most perfect. As a rule, their brief songs have reference either to something good to eat, to some successful midnight foray, or to some grossly lewd subject, and those partaking of the latter nature meet with the greatest appreciation.

Tchowies are not transmitted from one generation to another, because, when the maker of a *tchowie* dies, all the songs of which he was author are as it were buried with him, inasmuch as they, in common with his very name, are studiously ignored from thenceforward, consequently they are quite forgotten in a very short space of time indeed.

This custom of endeavouring persistently to forget everything which had been in any way connected with the dead entirely precludes the possibility of anything of an historical nature having existence amongst them; in fact the most vital occurrence, if only dating a single generation back, is quite forgotten, that is to say, if the recounting thereof should necessitate the mention of a defunct aboriginal's name.

Corrobories.

Their corrobories, with regard to diversity, are about as meagre as are their *tchowies*; they merely consist of a series of grotesque contortions and coarse postures, all however requiring considerable muscular exertion in their performance, and all (strange though it may seem) performed in most execllent time. When seen for the first time, a corroborie does certainly offer a considerable degree of interest; I of course do not mean such as are got up

expressly for display before the "whitefellow," but those only which are performed by them in their savage state and purely for their own special edification, when seen thus for the first time, the performance is without doubt a very novel one.

On my way home from a distant out station on one occasion (I was obliged to travel long after dark) I heard the sounds of a corroborie, coming from the direction of a lagoon which I knew well; this lagoon was about a quarter of a mile from the track which I was following, and in the middle of a reed-bed. As I was acquainted with a cattle path through the reeds to the lagoon, I determined to make one at the performance. I therefore tied my horse to a tree and followed the path through the reeds. I did not make much noise in my progress, as it scarcely would have been safe for me in those old days, had my presence as an uninvited spectator been suspected.

When I got within sight of the fire I deemed it prudent to get on my hands and knees, and in that uncomfortable position I wormed my way through the long reeds to their very edge, when the brilliantly lighted camp burst upon my view. As a matter of course when I found myself in such close proximity I lay very still indeed, not daring to move, lest the keen-scented dogs might be attracted to my post of observation.

Within a few minutes of my reaching the edge of the reeds, the aboriginal foot-lights, or fires with the same end, were freshened up, and the *lyoors* (who were seated in a semicircle a short distance from the lights, and whose duties consisted of the orchestral portion of the performance) gave a few spasmodic thuds on the **mullangie* (opossum skin drum) by way of calling the performers to the front; thereupon a hoary-headed savage, with a withered leg, stepped forward †*birrawarie* (time sticks) in hands, which he chinked in concert with the *mullangie* thuds, at the same time beginning a tchowie in a low monotonous tone, which ere long gradually swelled in volume; at the end of the first bar the *lyoors* chimed in, and the dancers sprang into the the lighted space, flourishing their weapons in savage delight as their lithesome limbs quivered in time to the savage music.

The hoary leader of the band, becoming warm and exited, rushed backwards and forwards along the crescent row of *lyoors*, singing out the *tchowie* as though his life depended on his performance, whilst flakes of foam spirted from his lips as it might do from the mouth of a hunted boar, by reason of his exceeding fervidness. The *lyoors* taking their time from him, became equally energetic in

**Mullangie*—This primitive instrument is formed by merely folding a cloak tightly up into a bunch, it is beaten by the open palm, and very musical.

†*Birrawarie*, time sticks, are made of two sections of wood 10 inches long and 2 inches in diameter, hardened by fire; they are held one in each hand, and when struck together give forth a sharp metallic ringing sound.

their performance upon the *mallangies*, and their high shrill treble mingling with the leader's bass, made altogether the most hideous accord that it was ever my ill fortune to listen to. Meantime the dancing had become as vehement as the music, the writhing and quivering of forty pairs of legs in unison, strung up to high pressure pitch by their savage *tchowie* and its barbarous accompaniments, made such an exhibition as it seldom falls to the lot of civilized man to witness now-a-days. The time now became faster and more fast, till at length the motion was altogether so rapid that individual legs could not be distinguished. Looking at the dancers when they had attained to this phase of the corroborie seemed like viewing a monster heap of serpents, heaving and coiling together in the throes of vital agony. But, alas! even aboriginal muscular humanity cannot keep up such high pressure motion for ever, so with a deafening clang, produced by the *birrawaries* and *mullangies* conjointly, the *tchowie* ceased instantaneously, and the sweltering dancers sank as one man exhausted in their tracks.

This grand finale was just about as much as my senses could well sustain, so I gladly crawled from the vicinage of the savage dancers, regained my horse, and rode quietly home.

OF GENERATING FIRE.

The aboriginal method of generating fire I imagine, pertains exclusively to the Australian tribes, at least I never heard of the same system being followed by other races. Their method is as follows :—A hard dry log is selected, having a deepish sun-crack in it; this crack is filled to within half an inch of the lips with dry grass well teased out to make it soft; then the operator having a piece of dry wood 14 inches long, and from 2 to 3 broad, fined down to a blunt edge on one side, holds this stick firmly by one end, and by both hands, and rubs the blunt edge backwards and forwards across the crack immediately above the part containing the dry grass. At first the rubbing is performed very slowly but with considerable pressure; as the crack however, begins to get filled with the filings, the rate of motion is accelerated until the filings quite fill the crack to the top, then for about the space of half a minute the rubbing is done so rapidly it is almost impossible to distinguish the rubbing stick. At this stage the operator suddenly pauses without lifting the rubber from the groove, which by this time he has cut across the crack, and gently fans the filings under the rubber with one hand, and if the smoke continues to ascend, the operator knows that the result is satisfactory, as fire has been produced, therefore, with great care he lifts out the dry grass upon which are the ignited filings (it is these filings which take fire, and not the rubber, as many would be inclined to suppose), folds the grass carefully about them, and gently waves them in the air, when, in a very little time, the grass bursts into flame.

The whole operation is most simple, and takes much less time to perform than I have taken to describe it, so easily is it done; indeed, I have many times had an aboriginal do it merely to get a light to my pipe. The best timber for effecting this purpose is red gum, pine, and salt-bush; this latter is specially good for making the rubber, and is consequently always employed for this purpose when comeatable.

Of Baangals.

In nearly every tribe there is one member who is esteemed learned beyond the average aboriginal; his profession is that of *Baangal* (doctor or magician), and he is supposed to be endowed with powers far beyond the finite grasp of humanity in general; he is therefore looked up to by the rest of the tribe with considerable awe; no one would knowingly offend him, as the least slight even would be sure to bring condign punishment on him who offered it.

The functions of these wise men are various, amongst which, bleeding and other surgical operations are not the least. As they elect to cure every ill to which aboriginal flesh is heir, from a simple headache up to the severest form of pulmonary consumption, they are seldom without a fair share of patients; the patients have the most perfect faith in their ministration, consequently they are as passive and docile in their hands as any doctor could wish; of course this implicit belief tends in a great measure towards a cure, whatever may be the ailment. When a patient recovers, the *Baangal* receives credit the most ample, which he accepts with the becoming grace of a duly qualified professor who is getting no more than his just meed. But, on the other hand, should grim death steal in and snatch the poor victim from under the very eyes of the *Baangal*, he does not get any blame, as the death is certain to be attributed to the malign influence of magic practised by the *Baangal* of some *Bukeen* (wild) tribe, to that end, and of which he is ignorant, therefore unable effectually to cope with. On these sad occasions, however, he tells his tribe that he will visit *Konikatnie* (water spirit) down in the deep waters of the lake, or river, and from him learn from whence the magic came which killed their brother, and then they can take ample and swift vengeance on their hidden foe.

When the curious ones of the tribe wish to discover that which is beyond aboriginal ken, they depute the *Baangal* to arrive at the desired knowledge through the medium of *Konikatnie;* thereupon, he disappears most mysteriously, and many days frequently pass before he returns, in a manner equally full of mystery to that of his departure. On some of those occasions he brings the desired information, on others again, he merely intimates that the matter sought for was not for them to pry into, therefore had better be

forgotten at once and for good, as the *Konikatnie* bears but badly any opposition to his expressed wishes as rendered by the *Baangal*. Of course any information he may be pleased to give at those times, as being the result of his interview with *Konikatnie*, is fiction, pure and simple, concocted by himself whilst absent from the tribe.

The *Baangal* is perfectly aware that if he would retain his power in the tribe, he must from time to time fabricate such romances as are calculated to have that effect; and, without doubt, the ability which these wise men display in this description of literary composition is truly marvellous.

Arabian tales of good and evil genii are as nothing compared to the wonders related by these impostors, and the dense ignorance of these people, together with their extraordinary superstition, induces them to give perfect credence to whatever the charlatan may be pleased to advance.

The manner in which they graduate for the office of *Baangal* is very peculiar indeed, and requires a vast amount of moral courage on the part of the would-be *Baangal*, to carry out the programme to a successful issue.

When a *Baangal* dies and has been buried, a *loondthal* (hut) is neatly erected over the grave, and whoever has the temerity to seek the vacant office of the defunct must go at sundown, the first night of the new moon, and place himself in the mausoleum, and there remain until sunrise the following morning.

This proceeding has to be continued every night until the moon has waxed and waned, and if he successfully completes the loathsome ordeal he is deemed to have graduated satisfactorily, and is consequently inducted forthwith to the office, with its train of honors, duties, and privations.

The *Baangals* are all under the firm conviction that they possess the power of causing sickness, even unto death, and the laymen of the tribes are quite certain that such is actually the case. This is, therefore, the principal cause of the awe these impostors inspire their more ignorant fellows with. They, however, never put this pretended power in practice on members of their own tribes, at least they pretend never to do so. Upon the *Bukeens*, on the other hand, they are continually trying the potency of their magic. The mode by which they carry out this fell art of theirs is extremely novel, although it has but a small modicum of the supernatural about it, as the following will plainly show:—

Should a *Baangal* in the course of his wanderings drop across an old encampment of *Bukeens*, he searches carefully about for some *debris* (such as bones) of the food they have eaten, but should his search for bones or some other kindred substance be unsuccessful, as frequently happens (from the fact of its being the habit common to all the aboriginal tribes to destroy by fire the bones of the game on which they have fed before they abandon a camp),

he anxiously scans the ground all round for feculent excrement, and should any of the *Bukeens*, from laziness or other cause, have omitted to use his paddle or to have used it carelessly, the vigilant *Baangal* pounces upon the unhidden fæces as a miser would on a treasure. After he has secured his savoury find, he lubricates a piece of opossum skin with the kidney fat of some of his former victims, and carefully wraps it round his treasure, after which yards of twine are wound round and round, each wind being what sailors term a half hitch, thus independent of the preceding one or the one which follows. If bones are found, their manner of treatment is the same.

At night, when all in the camp are quiet, the *Baangal* carefully takes his prize from the *mocoor mocoor* (bag), beginning a low monotonous chaunt, whilst he thrusts one end of the prepared roll into the fire; the fire is small by design. During the process of gradual combustion the chaunt is continued, sometimes low as a weak child's wail heard a considerable distance off, and again swelling up into the sonorous tones of a strong man's agony, yet never losing its weird monotony. The chaunt consists of sound principally, with an occasional interjected request to *Konikatnie*. Should he wish to kill the *Bukeen* outright in one night, he keeps up the chaunt, and pushes the burning roll forward into the glowing embers. As it consumes, and when the last vestige of it has disappeared in unsavoury smoke, the life of the *Baangal's* victim has ceased.

Should the *Baangal*, however, wish to prolong the dying agonies of his foe, he merely burns a small portion of the roll nightly, chaunting his incantation during the process; and should months pass ere the roll is totally burned, so long will the torture of his victim continue.

All aboriginal deaths, unless such as are caused by violence alone, and indeed every ailment by which they are stricken from time to time as well, are attributed to the malign powers possessed by hostile *Baangals*, and all the arguments and ridicule in creation will not cause them to alter their belief one iota.

When discussing the matter with them, and to prove the imposture practised on them by their *Baangals*, I have offered myself as a subject to be operated on by any of their *Baangals* they might select, telling them that it would not be necessary to complete the process to prove their case, the mere fact of my being made slightly ill would be proof to me perfectly conclusive that their *Baangals* were all they claimed them to be.

To them this offer of mine seemed so ridiculously absurd, they merely laughed at me, saying,—*Bumbuma wirrumpola nginty* (stupied ears you). Too much you whitefellow. Not that one *Baangal* belonging to you. What for you *bumbuma poorp?* (Stupid head).

PHILOLOGY.

According to various philologists, the structural basis of most primitive tongues is to be found in sounds and sights in nature, and in natural feelings. Thus, the sound noticed most frequently as arising from the wind blowing through some common medium is likely to be adopted as its name; the same thing holds good with regard to animals, they being usually designated by their respective calls. Heat and cold are named according to the ejaculations induced by each.

Trees, grass, water, fire, and earth are called after some plainly seen peculiarity.

In this manner or method, it is quite possible for a language to originate, and to become after many centuries of practice, quite copious enough for all common purposes in life's every day intercourse.

This principle however is altogether lacking in the dialects of these aborigines—natural objects, feelings, and appearances, have never seemingly been called in to aid in their construction; had they been so, the numerous aboriginal dialects would have been much less meagre, and more similar than inquirers have found them.

The lack of similarity is most astonishing, considering how closely the territories of these tribes approximate; that it is so, however, is an incontrovertible fact, to which any one can speak who has had the opportunity of familiar intercourse with the various tribes. Every tribe speaks a perfectly distinct tongue, which is altogether unintelligible to aborigines out of its own pale; and when I state that about every 50 miles square of this lacustrine area possesses a tribe, having a dialect of its own, it can well be imagined the diversity of tongues by which the philologist who undertakes the task of reducing the languages of these tribes to rule is met; in fact it will be seen at once that such a project is not very feasible.

Were the terms meaning the same things, in the various tribes, traceable to common roots, then of course the difficulty would be surmounted easily enough; but as this is not the case in any instance, the inquirer is at a loss to know from whence the words proceed which go to the formation of the numerous dialects, or in what manner they were originally evolved.

To show how very dissimilar the dialects are, I give below a few examples taken from two adjoining tribes; but before doing so, I may here again state that, in *all* cases, the negative of the dialect spoken is the name of the tribe which speaks it.

English.	Watty Watty Tribe,	Litchoo Litchoo Tribe.
No	Watty	Litchoo.
Yes	Eyer	Ngo.
Sun	Euroka	Nowie.
Moon	Mitian	Bocobothal.
Belly	Wotchowoo	Bingee.
Cold	Yebra	Mirrinumoo.
Dog	Wirrangin	Cul.

These examples though few, are quite ample enough to show how very unlike these dialects are, and the same dissimilarity holds good throughout the dialects of the whole of these tribes. Thus, therefore, one glance will suffice to show that it would be very absurd to endeavour to compile a work on these diverse tongues, with the view of its having general application; an endemic production of the kind would be practicable enough, but then the value thereof would be absolutely nil outside the precincts of the tribe from whose dialect it might be compiled. The *Ngalla Wattoos*, it is true, were linguists sufficient to be able to converse with the various tribes all round their own. Had these travelled men still been extant, their extended tribal knowledge would have been of incalculable service to the inquirer in matters pertaining to the multifarious dialects of the aborigines; as, however, the occupations of these men vanished as settlement advanced, the task to the philologist now-a-days is both wearisome and unsatisfactory.

The paucity of words which go to the formation of any one of these dialects precludes the remotest possibility of anything like a readable translation of even the commonest conversation, as the same word is frequently applied in many different ways, and it is only by the inflections, prolongations, &c., thereof that what it means to imply can be understood; therefore, unless to the initiated, a sentence translated into English verbatim would be all but unintelligible. Of course there are many common simple sentences such as any one, however obtuse, might readily understand, but to obtain anything approaching to a general knowledge of these dialects, so as to be enabled to apply it with any hopes of success, a life's experience, together with continual intercourse, supplemented by unflagging observation, is absolutely necessary. It would be quite impossible to teach these dialects by rule, without first forming a code of signs, whereby to denote the various accentuations, inflections, prolongations, &c.

These dialects are quite innocent of everything in the shape of grammar, grammatical relations being denoted by prolongations, accentuations, or position, each or either of which changes the meanings of different words entirely.

In illustration of the extreme meagreness of these tongues, I give the few following examples:—

Kayanie, water.
Tolkine kayanie, thirsty.
Mirnen kayanie, tears.
Kooroomboo kayanic, milk.
Birra, dead.
Birra wotchowoo, hungry.
Bocoin wotchowoo, stuffed with food.

It can readily be seen from the foregoing that the dialects of these people are about as meagre in quality and quantity as they can well be. If they were but ever so little more so, it would be most difficult, if not altogether impossible, for the aborigines to convey their thoughts or make their requirements known to each other.

From the Middle Darling, right through to beyond Cooper's Creek, and stretching thence to Lake Hope, in South Australia, the aborigines all speak the same tongue, or nearly the same; at all events, over that area of Central Australia they can readily understand each other without the intervention of *Ngalla Wattows.* *

I attribute this circumstance to the fact of that region being a very dry and arid one, having but few permanent waters in seasons of droughts, so that all the native tribes of that inhospitable country are compelled, during such seasons, to assemble round these waters, there to dwell together, oftentimes for many months at a time, and doubtless, on occasions of excessive drought, for a year, or perhaps even longer than that. At such periods a general amnesty must prevail amongst the tribes so assembled, otherwise total extermination would quickly ensue.

The fact of the tribes inhabiting so extensive an area all speaking one tongue induces me to imagine that the inhabitants of Australia, originally spread over the country from the neighbourhood of the Gulf of Carpentaria, breaking up into small sections, such as families, so that food might be found for all, this breaking up taking place after getting well south to the country of rivers and creeks, then each section or family diverging to the right or left, as the fancy inclined them, thus forming the nuclei of the various tribes as found by the colonists; the dissimilarity of the various dialects to what I deem the parent one, that is, the one spoken by the inhabitants of Central Australia, being fully accounted for by the persistent endeavour to forget, which I have before shown to be one of the leading characteristics of the aborigines.

Should my theory of the course followed by the earliest of this race be correct, it would not be altogether beyond the pale of possibility to trace these people back even to pre-historic man, whose remains have frequently been found in Europe, side by side with the kitchen midden, stone axe, and spear-barb, all of which pertain in exact similitude, at this day, to the aborigines of Australia.

Personal nomenclature is, in almost every instance, due to individual characteristics, or peculiarities perceivable in physique

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* I am indebted to my old friend, the late John M'Kinlay, Esq., the eminent explorer, for this interesting fact.

or manner, as the few following examples will clearly enough show :—

Mirmile Mirnew	Squint-eyed.
Kyup Mirnew	One-eyed.
Yandy Murnangin	Left-handed.
Mirmile Tchantchew	Crooked Nose.
Cowendurn	The Creeper.
Walpa Chinangin	Burnt Foot.
Bokeroin	The Breaker.
Waikeroo Woorinew..............	Ugly Mouth.

There are numerous other names which doubtless arose from equally perceptible features, but being rather objectionable. I do not care to quote them.

Names of places generally arise from local features, or from some occurrence vivid enough to be worthy of note. Below are a few examples by way of illustration :—

Chittoo Beal	End of Gum Timber.
Workin Dolo	Black Stump.
Na nowie	The Sun.
Bocoin Tcherik	Broken Reed.
Mirmile Maroong	Crooked Pine.

In the aboriginal alphabet, there are neither *f* nor *x*, *p* being used for the former and *k* for the latter.

In concluding this paper, I may venture to say that these tribes, when I first became acquainted with them, were numerically stronger, besides being physically a finer race, than any other tribes in the Colony, the abundance of easily procured and nutritious food being the main factor of this result.

The white man's universal civilizing agent, rum, however, with its attendant evils, has unfortunately reduced this once athletic and numerous people, until now not a tithe of the original numbers remain, and the scanty remnant are but sorry specimens of the muscular athletes from whom they are descended.

On the Waianamatta Shales.

By the Rev. J. E. Tenison-Woods, F.G.S., F.L.S., V.-Pres. Linn. Soc. N.S.W., Hon. Mem. Roy. Soc. N.S.W., Tasmania, S. Australia, &c., &c.

[*Read before the Royal Society of N.S.W., 4 July, 1883.*]

The name of the Waianamatta beds has been given to a supposed group or series of strata which are said to lie above the Hawkesbury sandstone. The name is derived from Waianamatta Creek, the native or aboriginal designation of South Creek, which, arising from the Cut Hills, joins the Hawkesbury River near Windsor. The area of the Waianamatta basin, as it is termed in the late Rev. W. B. Clarke's "Sedimentary Formations of New South Wales," 4th and last edition, is laid down in the geological map prefixed to that work. It is there represented as being of an irregular oblong, about 50 miles long, from north to south, and with an average width of 15 miles. The basin thus represented runs nearly parallel with the coast and the Blue Mountains, at about equal distances from both.

Mr. Clarke's definition.—The following is the definition of Mr. Clarke, taken from the same edition of his "Sedimentary Formations," p. 72: "Waianamatta Beds.—The Hawkesbury rocks are succeeded by another group or series of strata named by me from the Waianamatta or South Creek, which runs longitudinally through the basin which fills in the area between a surrounding enclosure of the former series, which must have been broken up in part, and denuded either completely before or during the deposit of the sandstone overlying the coal measures. The deep ravines which mark the Hawkesbury rocks give rise to rounded, smooth, undulating, softer, argillaceous strata, in the bottom of the creeks of which, and in the beds of the river Nepean or Hawkesbury, and of George's River, are marks of old erosion in the harder rocks below the argillaceous shales. Pot-holes are very common in the Hawkesbury beds, under the Wianamatta strata, where exposed at the points of junction, at some distance from the present creeks and drainage channels. Such may be traced at Myrtle Creek, near Picton, and on the Windsor Road, near Parramatta. These certainly prove a partial or general erosion before the whole series of the Waianamatta strata were laid down. The nearest beds of the latter to the underlying Hawkesbury rocks are shales, which have occasionally filled in

hollows previously existing, or contributed patches forming considerable masses as well as thin layers to the uppermost Hawkesbury rocks. In this way fishes have been found at various levels in shale patches, as on the Blue Mountains, at Parramatta, at Biloela (or Cockatoo) Island, and other places near Sydney. The Waianamatta beds are, however, not all shale, for there are fine sandstones more compact and heavier than the Hawkesbury, calcareous sandstones and ferruginous nodules, bearing fishes and small fresh-water molluscs, which remind one of the somewhat similar nodules of Permian beds of Germany."

It is difficult to gather the meaning of the author in this passage. He speaks of a "basin which fills in the area between a surrounding enclosure of the *former series*." One would imagine that the "former series" here referred to is the Hawkesbury formation, but he goes on to refer to the series as being "broken up and denuded either completely before or during the deposit of the sandstone." Clearly here the rocks referred to are palæozoic formations anterior to the coal, which must in this hypothesis have entirely disappeared, since nothing is seen of them now. Then, if the enclosure has been broken up and denuded away, it is impossible to arrange for the basin. Lastly, according to this statement, both the Hawkesbury and Waianamatta must fill up the basin. The difficulties of all these positions will be dealt with in the following paper.

Mr. Clarke then goes on to speak of the fossil fish found in these shales, also of varities of iron ore, fossil wood, plant impressions, and calcareous sandstones, "which latter," he says, "form the highest levels and summits of insulated hills that attain but moderate elevation (1,100–1,300 feet) in the centre or on the outskirts of the basin, which latter is chiefly confined to the heart of the county of Cumberland and part of Camden, of which Bulbunmatta or Razorback Range and Menangle Sugarloaf are outlying relics of a once wider extended plateau."

Mr. Beete Jukes also refers to Mr. Clarke's conclusions, and coincides with them. In a paper read before the Geological Society of London in 1847 (see vol. iii-iv, p. 2?4), he describes these shales as 300 feet thick, lying on the top of the Hawkesbury sandstone.

From these opinions, which have been followed without question by nearly every subsequent writer, we gather (1) that there is a distinct formation of shale lying on the top of the Hawkesbury sandstone; (2) that it lies in a basin on the eroded surface of the older formations between the Blue Mountains and the sea; (3) that the shale on the tops of such hills as Mount Sugarloaf, Razorback, and other hills in the neighbourhood of Campbelltown, are the outliers and fragments of what was once a plateau of Wianamatta rock.

Incorrectness of these views.—Having carefully visited the localities in which the Waianamatta formation is said to exist, I have come to quite different conclusions from the late Messrs. Clarke and Jukes, and it is with the greatest respect for both these eminent and veteran geologists that I record my opinions in opposition to theirs. But it is only lately that facilities have been accessible to geologists to enable them to examine the true nature of these shales. The cuttings and tunnels in connection with the new waterworks have afforded great advantages for the inspection of the strata. I do not think that either of the two gentlemen referred to would have written as they did concerning the Wianamatta had they examined the ground with the aid of the recent excavations. The conclusions I have come to are—(1) that the shales in question do not lie on the top of the Hawkesbury sandstone, but are intercalated with it; (2) that these shales, which lie on the summits of such hills as Sugarloaf, Razorback, Kenny's Hill, cannot be outliers of one elevated plateau, because they are mere seams of shale from the Hawkesbury sandstone, which occupy quite different levels in that formation; (3) that these shales do not occupy any basin in the formerly eroded rocks; (4) that both in the contained fossils and the stratification the shales are one with the Hawkesbury sandstone; (5) consequently there is no such formation as the Waianamatta. I shall discuss the evidence for these conclusions separately.

1. Shales not lying on the top of Hawkesbury sandstone.—The highest portions of the Hawkesbury rocks are quite destitute of any shales. At Clarence siding, on the railway, 3,658 feet above the sea, there is not a trace of shale, nor indeed along any of the large sections of the rocks. A few plant remains at Mount Victoria cannot be the remains of a formation such as the Waianamatta. Again, at all the sections of the sea-coast above Bulli and Wollongong the sandstone is the uppermost formation.

But it may be contended that the shales were deposited in a basin and did not reach the higher summits. Mr. Clarke supposed that there was first a valley of erosion cut out in the palœozoic rocks, and the Waianamatta was deposited in this valley or trough. But throughout the sandstone we find beds of shale from 3 feet in thickness to irregularly banded grits and shales of much greater dimensions. These differ in no way from the so-called Waianamatta at Campbelltown and the neighbouring valley. Even in this valley much of the highest portions of the sandstone have no shale upon them. In every gully or watercourse the sandstone crops out, and finally sandstone without any shale upon it can be seen along the valley of the Nepean at every level from 200 up to 1,000 feet.

So-called Waianamatta shale intercalated with the Hawkesbury sandstone.—The evidence of this is very visible from the various

levels at which the shale is found, and secondly from its moderate thickness. Along the course of the canal the cuttings reveal many irregular beds of shale. They undulate, not from upheaval but from the irregularity of the strata. Where the erosion of the natural surface has brought them within reach of decomposition, they form a mass of black soil exactly like what is termed Waianamatta. In the many sections exposed I have not been able to find a single instance of Waianamatta shale which was not clearly intercalated between the sandstone strata.

Tho tunnels have all manifested the same fact. If the Waianamatta were one formation filling up a basin of the eroded Hawkesbury sandstone, the tunnels and shafts should reveal in some portion of the valley strata of shale of some considerable thic ness. I examined the materials of all the shafts. Sandstone predominated, with beds of shale of varying thickness like all the Hawkesbury rocks. What is called Waianamatta shale is a regularly stratified rock, horizontally disposed, with fine calcareous lines of stratification or an alternation of blue grey and blackish lines. On the planes of bedding there are plant remains and a good deal of silvery mica. They are jointed, and the joints have a fine calcareous facing. Now this is exactly the character of nearly all the shales which run through the Hawkesbury rocks. The latter may be always known by its white appearance where fresh quarried, yellow and red where weathered, and by the false bedding. This is a universal character and a most distinct one. The rock of the Hawkesbury series is always false bedded, the shales never. In the Sugarloaf Hill referred to by Mr. Clarke, shafts have been sunk and a tunnel cut right through it. There are many beds of shale of varying thickness but sandstone (very carbonaceous) with some false bedding predominates. The usual character of these hills is best seen from the following records of the strata passed through in five shafts along the Nepean tunnel.

Shaft No. 1, 631 *feet above sea-level.*

Sandstone, white and false-bedded with round grains	73 feet.
Shale, with plant impressions	13 ,,
Sandstone as before	124½ ,,
Tota thickness of strata ...	210½ feet.

Shaft No. 2, 637 *feet above sea-level.*

Clay and loose boulders	10 feet.
Very impure shale, or jointed sandstone ...	15 ,,
Sandstone false-bedded	189½ ,,
Total thickness of strata ...	214½ feet.

Shaft No. 3, 675 feet above sea-level.

Clay	9	feet.
Jointed sandstone and layers of shale ...	11	"
Sandstone	222	"
Shale	½	"
Sandstone and shale	9	"
Total thickness of strata ...	251½	feet.

Shaft No. 4, about 721 feet above sea-level.

Clay	10	feet.
Jointed sandstone and layers of shale ...	17½	"
Shale	1½	"
Sandstone	25	"
Shale	4½	"
Sandstone	117½	"
Shale	4	"
Sandstone	15	"
Shale	½	"
Sandstone	101	"
Total thickness of strata ...	296½	feet.

Shaft No. 5, 752 feet above sea-level.

Clay	8	feet.
Shale	13	"
Sandstone	3	"
Shaly sandstone	7	"
Sandstone	293	"
Total thickness of strata ...	324	feet.

It will be observed that these shafts were sunk outside the Waianamatta basin, as laid down in Clarke's map, but the limits of that map are merely sketched in, and in any case the shafts sunk in the portions marked as Waianamatta are just of the same character as those specified above. I found in all beds of shale of varying thickness alternating with Hawkesbury sandstone.

2. *The shales of Sugarloaf, Kenny's Hill, Razor-back, &c., not portions of a former plateau.*—This is evident from the fact that they occupy such different levels, and there are no faults or dislocations to account for it. It is remarkable that, though there are numerous volcanic dykes breaking through the sandstone and shale, there is little disturbance. The beds broken through are tilted a little at the sides of the dykes, but this extends only a very

short distance. As a rule the Hawkesbury rocks are remarkably uniform and undisturbed; they may be traced over miles of country without the least evidence of tilting or upheaval. At the sides of creeks and gulleys one observes frequently a regular inclination of the sandstone towards the centre from each side, not due to any elevation or tilting, but showing that the levels or contours of the surface on which the sands were deposited were similar to what they are now.

By observing the levels of the various masses of shales in different hills we shall see how they could not have belonged to one plateau. The shale on Mount Sugarloaf is about 700 feet above the sea; that on Razor-back Range is in places 500 feet higher. There is no dip from one to the other, and there are apparently no faults or subsidence. Moreover, a shaft has been sunk close to the summit of Mount Sugarloaf, and a tunnel cut very nearly through its centre. All the spoil-heaps of both these show that Sugarloaf is just like the rest of the Hawkesbury sandstone, with beds of shale running through it. It has neither more nor less shale than any other part of the formation. Finally, the character of the shale is not that of a large deposit which has filled up the valley; quite as much is covered by sandstone as exposed on the surface; in fact, wherever it can be fairly followed, it is found to be a mere seam rarely more than a few feet in thickness. To claim for it a thickness of 300 feet is utterly incorrect.

If we stand on any of the elevations in the Nepean valley, we shall see that the hills of shale occupy very different levels. If they all belonged to one formation its thickness should be nearer to 600 than 300 feet, but when each of these hills is examined in detail the shale is discovered to be a seam amid the Hawkesbury rocks. Thus, at the end of Woodhcuse's paddock (Mount Gilead), and between it and the canal, there is a high bank of shale, which is (say) 430 feet above the sea-level. As this is followed towards Sugarloaf, sandstone takes its place. At Brook's Point another thick seam of shale is seen to be covered by the sandstone. Many other examples could be given.

No basin formed in eroded rocks.—There is nothing in the physical features of the country marked as Waianamatta shale to show that is a large basin or ever has been. There is a gradual rise from the sea to the Blue Mountains, and no traces of any former eastern barrier, which must have been at least 600 feet high to meet the requirements of a basin such as the so-called Waianamatta, and the height at which its deposits are found. The almost westerly direction of the railway from Sydney to Parramatta meets with no barrier higher than 36 feet, and this itself is composed of shale. From this point the line keeps along a S.S.W. direction, crossing diagonally all the drainage valleys. Except in these there is a steady rise, very slight and gradual it is true, but

still a slope, and not a basin. Campbelltown is 209 feet above the sea at the railway station. There is a rise of sandstone and shale between it and the valley of the Nepean, which is only 80 feet below this rise, and it is 150 feet above Campbelltown. From this there is a much more rapid rise towards the main range. The lowest part of the so-called basin is the valley of the Nepean, and this, we have seen, is 150 feet higher than the entrance of the valley, to which it descends in a series of terraces, instead of being itself a basin.

We find the same thing in crossing the so-called basin, where it is marked in the map of Mr. Clarke. From Parramatta to Blacktown there is a rise of about 100 feet. From this to the valley of the Nepean the country is a series of low ridges, divided by valleys of erosion, through which the drainage of the country flows. These valleys are Eastern Creek, Roper's Creek, and South or Waianamatta Creek. The greatest depth to which these valleys have been eroded is 77 feet below the summit of the Blacktown plateau. None of them are wide. The ridges between them rise to within 20 feet of the highest portion of the plateau, but as they are followed south they rise even above it. Some of the valleys cut through shale and some through sandstone. So that clearly there is no basin here. The true description of its physical character is that there is a low plateau, not so high as that above Campbelltown by less than 40 feet. This plateau slopes towards the north-east, down which the streams drain by the Nepean and Hawkesbury into the sea. The Campbelltown area is merely a higher portion of this large plain. The valley of the Nepean is the widest of these eroded channels. It is rather over a mile in width at Penrith, and 97 feet below the highest part of the plain at Blacktown.

When we examine the rocks of this plateau they do not offer any evidence of having been deposited in a basin of wide extent. The strata do not show any regular depression towards any centre. The shales may have in some cases been deposited in shallow lagoons of some extent, but still no more than mere shallow areas in the sandstone, and disconnected with each other. This portion of the subject will be referred to again.

Palæontologically the shales one with the Hawkesbury rocks.—If the Waianamatta is to be considered as a separate formation, it must be on account of its clearly lying above the Hawkesbury, and having a distinct fauna of its own. Neither of these positions can be sustained. From what has been already said, it is certain that we constantly meet with sandstone, in no way distinguishable from the Hawkesbury rocks, lying above shales in no way distinguishable from what has elsewhere been called Waianamatta shales I need not repeat the facts bearing out these conclusions.

The palæontological evidence is very complete. The shales are much richer in fossils than the sandstone, but they are not usually

so well preserved. However, a careful search, aided by some experience in Australian fossil plants, has enabled me to identify the following fossils in the localities given :—

Fossil Flora of the Shale.

Alethopteris (Pecopteris) australis, Morr. ...	Sugarloaf Hill
Thinnfeldia odontopteroides, Morr.	Kenny's Hill
Phyllotheca concinna, Tenison-Woods	Mount Gilead
Podozamites distans, Presl.	South Creek
Podozamites sp.	Sugarloaf Hill
Gleichenia ?	Sugarloaf Hill
Macrotæniopteris waianamattæ, Feistm.... ...	Kenny's Hill

Hawkesbury Sandstone.

Alethopteris australis, Morr.	Mount Victoria
Thinnfeldia odontopteroides, Morr. ...	Mount Victoria & Dubbo
Thinnfeldia media, Tenison-Woods	Dubbo
Phyllotheca sp ?	Mount Victoria, Woolloomooloo
Podozamites distans?	Woolloomooloo Bay
Gleichenia dubia, Feistm.	Mount Victoria
Macrotæniopteris waianamattæ, Feist.	Mount Victoria

The above are the species which have been identified with certainty, but there can be no doubt that the general character of the fossils is the same, and only the mode of preservation is different. Dr. Feistmantel has pointed out that the formations are closely connected. In the lists above given I have adhered nearly to those forms which I have identified myself, because in former enumerations I am inclined to think that not sufficient attention was paid to whether the fossils were taken from the sandstone or shale. Moreover, I think that the limits of what were called the Waianamatta shales and the Hawkesbury sandstones were not defined, so that it was not certain whether what one observer regarded as belonging to one formation was not accepted in an opposite sense by others.

But there is one other place where the palæontological identity of the shales and sandstones meet, and that is in the mesozoic coal basin around Moreton Bay. All the fossils of the shales and sandstones about our Blue Mountains are intermingled there. All the evidence on this point should form a separate essay, to which I hope to address myself shortly. But I may mention an important fact for which hereafter I shall offer proofs in detail. The Ipswich or Moreton Bay coal beds are identical in their fossil contents with the shales and sandstones of all the so-called carbonaceous shales of Victoria, at Geelong, Cape Otway, Western Victoria, &c.; they also have the closest relations with the Jurassic plant beds of India, of Siberia, and Yorkshire in England; from which we may conclude that in Australia the Lower Jura is largely represented, and that our Hawkesbury rocks and shales belong to that period.

Origin of the Shales.—It does not seem very easy to account for the shales in the Hawkesbury sandstone. They are impure carbonaceous sandstones, with a good deal of silvery mica and such other minerals as would result from the decomposition of felspathic or granitic rocks with vegetable matter. It has been commonly agreed to call them lacustrine shales, but not a single item of evidence has ever been adduced that they occupied the sites of fresh or saltwater lakes. Fossil fish have been found but rarely, and those specimens I have seen were not in shale but a horizontally stratified sandstone. We have, however, a horizontal finely laminated stratification in many localities which looks like the action of water, and is not unlike some of the lacustrine strata of the central provinces of France. But every other clue disappears. No freshwater shells or remains have been found. The present lacustrine fauna of the world has few very immediate connections with any older than the Lower Cretaceous, but there are well recognized freshwater fauna of the age of these beds. The freshwater bands of the Purbeck beds contains species of genera which still exist, such as *Paludina, Limnea, Planorbis, Physa, Valvata, Unio, and Cyclas.* I do not think that we are justified in regarding our shales as of lacustrine origin until some evidence of this kind is forthcoming. Besides, it will be remarked by the most casual observer that the bands of shale do not occupy depressions or basins in every case; they are of undulating outline, and often pass up inclines and over elevations which have existed on the former surface. I am inclined to think that these bands mark periods during which a thick vegetable growth flourished upon the surface. The plants we find are all land plants, and the abundant remains of roots show pretty clearly that they grew in the place where they are now found. It seems to have been a heathy stunted vegetation, such as grows even now on poor sandy soil. The common fossil, *Alethopteris australis*, is not to be distinguished from an Oolitic fossil Fern which is found all over the world in rocks of the same age, and, as far as appearances go, it is very like the common *Pteris aquilina*, which at the present day also occurs in moist, sandy, and desert places all over the world. Probably *Alethopteris* was an *Asplenium*, but nevertheless its habits were those of the living *Pteris*. Now there are places on the east coast of Australia where a level poor soil gives rise in the course of time to a black carbonaceous deposit, such as we see here. It arises from the decomposition of the plants which grow on the surface. Sometimes shallow marshes will occur amidst them. Loose sand drifted across these moorlands would entomb them, and cause them, I have little doubt, to present such appearances in section as the Hawkesbury shales. I imagine that they represent long periods of time, and that their highly fissile character is partly the effect of pressure.

It is to be remarked further that plant impressions of a black carbonaceous appearance are found through the sandstone, showing an occasional growth of plants on the sandy surface. At any rate, in the presence of such plant remains, often with roots, we have no other evidence but that of a terrestrial vegetation, and are not justified in having recourse to any other hypothesis. The plant remains are not aquatic ; and there are strong reasons for supposing that *Thinnfeldia* was a Conifer allied to *Phyllocladus* (our Celery-topped Pine), and not a fern.

JOINTS.—It will be remarked that the shales are conspicuously jointed with a uniform direction. I have found that the jointing is always at right angles to the strike of the dykes of diorite, basaltic rock and trap, and which so numerously intersect the formation. We may regard these dykes as so many wedges of rock inserted in the mass, and of course increasing the lateral pressure. This would be quite sufficient to account for the joints, which are obviously connected in direction with the volcanic intrusions.

DYKES.—All around the Nepean Valley dykes are common. It is remarkable that they have disturbed the surface but little, and the Hawkesbury sandstone is only tilted a few inches at each side, the elevation extending a few yards in a horizontal direction. In the immediate vicinity of the dykes the sandstone is metamorphosed into a hard siliceous rock, sometimes not distinguishable from the injected material. This is easily understood if we remember that the sands are felspathic, and probably altered back again by heat into the form of the granitoid rock from which they were originally derived. The surface portions of both dykes and matrix are much altered by water, and these are the only portions I have been able to examine.

Shales on Sydney sandstones.—In a few places around Sydney shales are found in somewhat thicker beds than the shales near Campbelltown, but they are different in character, and far less carbonaceous. They are at least 100 feet lower than any of those round the valley of the Nepean.

That they are of the same character as the shales in other portions of the formation can be seen from the following section obtained in a boring at the Oaks Brickfield, near Neutral Bay :—

Height above the sea, about 150 *feet.*

Shale	16 feet.
Sandstone...	104 ,,
Shale	23 ,,
Sandstone...	208 ,,
	351 feet.

The shale here is somewhat of the same composition as elsewhere, but less micaceous, and with considerably less carbonaceous

matter. It is a very pure fire-clay, with so little iron in it as to render it very valuable for fire-resisting purposes.

In the boring for coal at Moore Park by the Diamond Drill Co., at 20 feet above the sea, the section gave 143 feet loose sand, 900 feet false-bedded sandstone with occasional shaly seams, but no record of the amount of shale was preserved, as the cores themselves were kept for exhibition at the Garden Palace, and where they were destroyed by fire. A band of ironstone 263 feet thick was found at the base of the Hawkesbury rocks, and then the coal measures were reached and bored for 550 feet without meeting coal.

Economical value of the Shales.—Up to this no great use has been made of the shales, but there can be no doubt that they are of considerable commercial value. For the manufacture of pottery, certain patches of shale would be found to answer as well as any in the world. It consists of a true silicate of alumina, finely levigated and mixed together, with very little iron or other minerals. The alumina predominates, and this is to the advantage of the ware. Generally speaking, the more the alumina the harder the ware, and the more silica the softer the ware ; the latter is less dense and bears less heat than the former. Bricks have been made from the shale from a very early date in the Colony. They are largely made from the shale at Lithgow ; at Waterloo, by Messrs. Goodlet & Smith ; and at the Oaks' brick-works, at Neutral Bay, and other places. In the latter locality the shale is particularly free from iron and grit and contains more alumina, so that a very white brick comes from the kiln. It is very tough, and shows a colour and structure which manifests how easily fine pottery could be made of the same substance ; in fact it seems a pity to use such material for bricks. I am told that a high price is paid for fire-bricks to use with these, the builders evidently not being aware that no finer fire-brick could be found than that manufactured from this clay. No doubt it will be largely used and its value appreciated before long : the only matter of regret is that near Sydney the supply of shale is somewhat limited.

For all the reasons previously given, I think that the term "Waianamatta formation" should be abandoned by geologists, as not being represented by any distinct group of rocks.

I have to express my thanks to Mr. Keele and Mr. McKinney, and other assistant engineers, for their kindness and attention to me during these investigations, especially in determining all the levels and making the measurements of strata. All these gentlemen, as assistant engineers in the Waterworks Department, were thoroughly acquainted with the locality, and showed me, during many days' research, every point of interest and importance.

Further remarks on Australian *Strophalosiæ*; and description of a new species of *Aucella*, from the Cretaceous Rocks of North-east Australia.

By R. Etheridge, Junr., F.G.S.

[*Read before the Royal Society of N. S. W., 4 July, 1883.*]

1.—NOTE ON AUSTRALIAN STROPHALOSIÆ.

Genus Strophalosia. King, 1844.

(Annals Nat. Hist., 1844, xviii. p. 28.)

Strophalosia Gerardi. King.

S. Gerardi. King, Annals Nat. Hist., 1846, xviii, p. 93.
S. Gerardi. King, Mon. Permian Foss. England, 1850, p. 96, t. 19, f. 6 & 7.
S. Gerardi. Etheridge Junr., Proc. R. Phys. Soc., Edinburgh, 1879–80, p. 294, t. 12, f. 34–37, t. 13, f. 38. [For general synonomy.]

Obs. The specific characters of this species have already been given elsewhere, and, with the exception of the degree of concavity of the dorsal valve, little or no alteration is needed. The description referred to was drawn up from the type specimen in the cabinet of Prof. W. King, kindly lent to me for the purpose, with other specimens, which I conceived belonged to this species, forwarded from Queensland by Mr. R. L. Jack. The shells now before me, obtained by Prof. Liversidge, F.R.S., will I think set at rest the question of the occurrence of this Himalayan species in Australian rocks, so far as one can judge from the meagre material at present in this country from the typical locality. The specimens sent by Prof. Liversidge show that the concavity of the dorsal valve varies to some extent in different individuals, from the deeply concave condition formerly described by me to the semi-concave form now referred to. The length of the hinge line is also very variable, long in some examples, short in others, although, as before stated, it never extends the whole width of the shell.

Furthermore, the examples of this species now under consideration give us an insight into the internal character of the ventral valve, but unfortunately not of the dorsal one. Wax casts of these interiors show the deep blunt umbonal cavity of the

beak, a reduction in the size, and a modification in the form of the teeth, entire absence of the imprint of the adductor muscles, smaller size of the cardinal muscle scars, and the deeply corrugated nature of the front interior portions of the valves. On the exterior of these specimens the lamellæ of growth and short projecting spine bases are exceedingly well shown.

When my former description of the Australian Strophalosiæ was written, I defined three species. The first of these was *Productus Clarkei*, Etheridge; the second, a form to which I gave the name of *S. Jukesii*; whilst the third was King's *S. Gerardi*. These I described fully, according to the material then at my disposal, and made the following remarks:—"It would not surprise me if, eventually, we have to unite the shells now described as *Strophalosia Clarkei*, Eth., *S. Gerardi*, King? and *S. Jukesii*, Eth. jun., in one variable species, although, as I have before said, such a proceeding would be premature, as the material to hand is not sufficient in itself."[1] Since the above was written I have not seen any evidence to justify a union of *S. Clarkei* with *S. Gerardi*. On the contrary, Prof. Liversidge's specimens, from the structure of the ventral valve, incline my opinion the other way; but as regards *S. Gerardi* and *S. Jukesii* the matter is not so clear, for these Darr River shells externally appear to unite the two species. The internal structure of the ventral valve of *S. Gerardi* is known to us, but not that of *S. Jukesii*; and similarly we are acquainted with that of the dorsal valve of the latter, but not of the former. A very decided difference is indicated by the prominent teeth which must have existed in the ventral valve of *S. Jukesii*, and of which there is no trace in the Darr shells I have referred to *S. Gerardi*. The present notes can only be looked upon as a further contribution to the solution of this interesting question, which must still remain an open one.

Loc.—Darr River.

FOSSILS FROM THE CRETACEOUS ROCKS OF N. E. AUSTRALIA.

Prof. Liversidge has also forwarded a few fossils from the cretaceous rocks of N. E. Australia. The specimens appear, from their external appearance, to be portions of boulders (or rounded blocks), and comprise Bivalves and Cephalopoda only.

The Bivalves consist of two species of *Inoceramus*, an *Aucella*, and possibly a *Monotis*, or allied genus.

The great variability of the shells forming the genus *Inoceramus* renders it very difficult to decide on the specific identity of its

[1] Proc. R. Phys. Soc., Edinb., 1879–80, p. 309.

individuals. As regards the Australian species, this is increased by the fact that in the only two collections hitherto made, the *Inocerami* could not be compared, owing to Prof. M'Coy's abbreviated descriptions[1] being unaccompanied by figures. One of Prof. Liversidge's specimens is apparently *I. Marathonensis*, Etheridge,[2] at least, my father believes it to be identical with the species so named by him in the Daintree Collection. It was obtained at "Landsborough Creek, a tributary of the Thomson River, and no great distance from the Flinders River waters." The second, *Inoceramus*, approaches the ordinary cretaceous species *I. problematicus*, d'Orbigny, or *I. striatus*, Mantell, but is more deltoid. From the same locality as the last.

In the same blocks with these *Inocerami* is a well-marked bivalve possessing the characters of *Aucella*, Keyserling, as laid down by the latter and the late Mr. Stoliczka,[3] and of which a more detailed account is given below. The *Monotis*-like bivalve need not be referred to further than to say that, except the partial outline of the shells and the radiating fine ridges, no other characters are distinguishable.

Passing to the Cephalopoda, we have, first, the remains of a large shell, a portion of a whorl, on the reverse of which the *Monotis*-like ivalves are preserved. It is possible this may be a well-grown example of Moore's *Crioceras Australe*,[4] with the ribs much more widely separated than in the figured example, but as the late Mr. Moore stated that they increase in the distance apart from one another, in the adult, this will not affect the question.

In the same blocks of stone with the *Inocerami* and the *Aucella* are two other well-marked Cephalopods. The first of these corresponds in every way with Prof. M'Coy's description of his *Ancyloceras Flindersi*[5] so far as the very terse remarks made by the former will enable one to judge. Here again we lack a figure, and the determination must remain in doubt. Although only a very small portion of the entire shell, it represents an individual of some size, in which the ribs fork on the sides, as described by M'Coy, and with a row of large, much compressed tubercles on the sides of the back. The section of our specimen is elliptical, but unfortunately that of *A. Flindersi* is not given by M'Coy. *Loc.*—Landesborough Creek.

The last specimen to be referred to is only a fragment. It may be only a small *Ancyloceras*, or a portion of a *Hamites*. The

1 Trans. R. Soc. Vict., 1866, vii, p. 50.
2 Quart. Jour. Geol. Soc., xxviii, p. 343, t. 22, f. 1.
3 Pal. Indica, iii, p. 390.
4 Quart. Jour. Geol. Soc., xxvi, 1870, p. 257, t. 15. f. 3.
5 Annals Nat Hist. 1867, xix, p. 356.

ribs on the back are in bundles of three, proceeding from a series of single nodes or tubercles at the sides ; here and there a rib will be much stronger than the others.

The following is the detailed description of the *Aucella.*

Genus AUCELLA. *Keyserling*, 1846.

(Reise in das Petschora-Land, p. 297.)

Gen. char. "Obliquely elongated, inequivalve, of thin structure, pearly within, and with concentric sulcations externally ; left valve strongly convex, with incurved beaks, a short posterior and an almost obsolete anterior ear, represented by a slight internal thickening ; margin of shell in front below the beak insinuated ; right valve flat or slightly convex near the umbo, with a small indistinct posterior and a still shorter anterior ear, generally a little twisted, and separated from the margin below by a deep byssal sinus ; hinge line in both valves straight, short, and in the right valve usually with a small blunt tooth ; ligament external, linear ; muscular scars small, posterior submarginal, anterior placed near the ear, and often almost obsolete." *(Stoliczka).*[1]

Obs. I have quoted Dr. Stoliczka's description of this interesting genus, as being the best and most comprehensive with which I am acquainted ; it is to all intents and purposes the same as the original by von Keyserling.

By most authors *Aucella* is said to be a Jurassic genus, but Eichwald believes the rocks from which the original examples were procured by Keyserling to be of Cretaceous age. Species definitely known to be of this period have been described by Stoliczka, Gabb, Conrad, and others, and there now appears to be no doubt of its existence during the epoch in question.

The late Mr. F. B. Meek[2] has very justly said that Keyserling's genus has not been so generally adopted as it should have been.

AUCELLA LIVERSIDGEI. SP. NOV.

Sp. char.—Obliquely sub-deltoid, very inequivalve, plano-convex. Left valve convex, inoceramiform, gibbous, and narrowed about the umbo, expanding ventrally ; beak or umbo prominent and much incurved anteriorly, greatly overhanging the hinge line ; anterior side vertical, the margin almost straight, and when seen from the inside deeply insinuated under the beak ; posterior side steep, obliquely expanding ; posterior ear and hinge margin very short ; ventral margin obliquely rounded ; surface with faint concentric undulations, which become more apparent and laminar towards the ventral margin. Right valve gently convex or

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[1] Pal. Indica, iii. p. 390.

[2] Pal. Up. Missouri (Smithsonian Contributions), by Meek and Hayden, 864, p. 53.

prominent about the umbonal region, flattened towards the ventral portion, obliquely rounded, with a larger and better developed posterior ear than in the left valve; anterior margin rounded; anterior ear more or less triangular, reposing completely in the insinuation of the anterior margin of the left valve, separated from the body of its own valve by a deep byssal sinus; beak small, but sharp and prominent; surface ornamented with concentric laminæ of growth. Hinge line of both valves short, but longest in the right; no tooth visible in the interior of the right valve.

Obs. A very interesting and unlooked for shell, presenting all the characteristic features of *Aucella*. It will form a very important addition to the Cretaceous Fauna of Australia. No mention of the genus is made as occurring in any of the collections examined from time to time by Professor McCoy, nor did the late Mr. Charles Moore enumerate it amongst the secondary fossils described by him from North Australia.[1]

Aucella Liversidgei is undoubtedly allied to two of the types of the genus, *A. Pallasii*, Keyserling,[2] and *A. crassicollis*, Keys.[3] In possessing the obliquity and short hinge line, it resembles the former; the left valve has the general form of the latter species, and a similar much incurved beak, whilst the right valve in all its peculiarities is almost identical with that of *A. Pallasii*. The resemblance of our shell to and its intermediate position between the two species in question is very remarkable. *A. Liversidgei* is also allied to the Indian Cretaceous species *A. parva*, Stoliczka,[4] but the left valve in the former is more inoceramiform than in the latter, and more oblique.

In *A. speluncaria*, Schlotheim,[5] there are radiating striæ, and our species is less deltoid and more regular, and there is no inflection of the ventral margin.

A. Hausmanni, Goldfuss,[6] from the Zechstein of Scharzfeld, is a much more slender shell than the Australian species, less convex, and more elongate from the beaks to the ventral margin. Another species, *A. Caucasica*, Abich,[7] possesses fine radiating striæ, to say nothing of a larger ear in the right valve, a more pointed and prominent umbo in the left, and a generally different outline to the valves. There appears to be at least one very interesting

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[1] Australian Mesozoic Geology and Palæontology. Quart. Jour. Geol. Soc., 1870, xxvi, p.p. 226, 261.
[2] Petschora Land, p. 299, f. 16, f. 1-7.
[3] *Ibid*, p. 300. t. 16. f. 9, 12.
[4] Pal. Indica, iii, p. 404, t. 33, f. 2-3.
[5] See Geinitz, Dyas. t. 14, f. 5-6.
[6] *Mytilus*, Petref. Germaniæ, ii, p. 168, t. 138, f. 4. *Aucella*, Geinitz, Dyas. p. 72, t. 14, f. 8 5.
[7] Zeit. d. Deutschen Geol. Gesellschaft, 1851, iii, p, 31, t. 2, f. 1.

British example of *Aucella*, the *A. gryphæoides*. J. de C. Sowerby, sp.,[1] but it has a much larger umbo in the left valve, and the general characters of the right are quite different.

The last species with which I am able to compare *A. Liversidgei* is the American Cretaceous form *A. Piochii* Gobb,[2] a very gibbous and thick shell through the valves, quite distinct from the Australian.

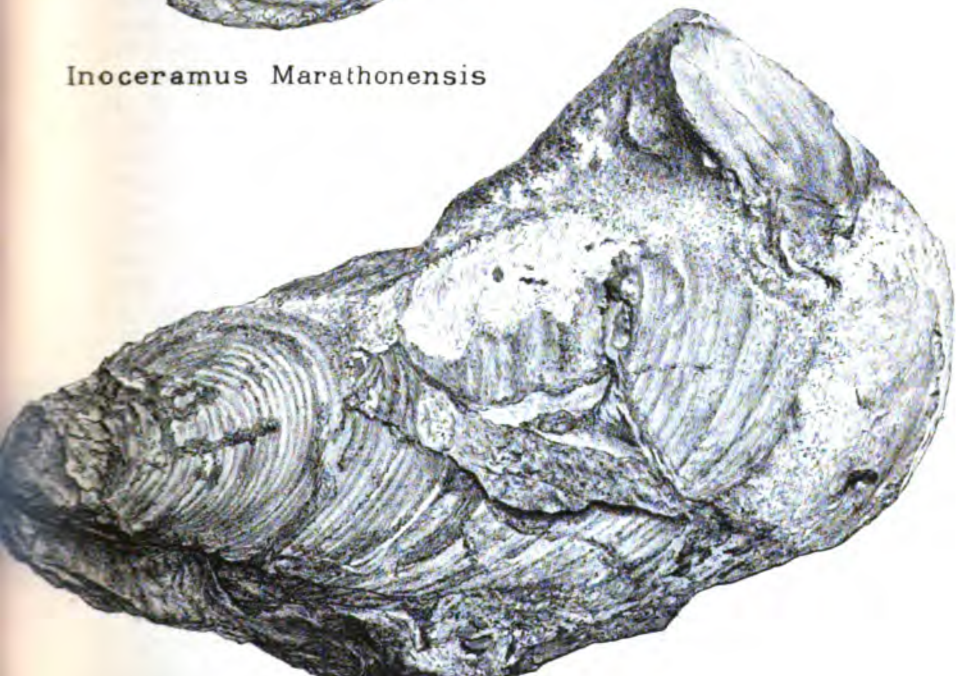
POSTCRIPT, Jan. 19th, 1884.

Since the above description was written, I have received for examination from Mr. R. L. Jack, Government Geologist for Northern Queensland, a very interesting collection of Cretaceous fossils, from Rockwood Station, Landsborough River, and other localities in Northern Queensland. They clearly belong to the horizon of the Queensland Cretaceous series denominated by Messrs. Daintree and Etheridge (Quart. Jour. Geo. Soc., 1872, xxviii, p. 325), the Hughenden Beds. Prominent amongst them was the shell I have above called *Aucella Liversidgei*, in all stages of growth and preservation, and also that referred to under the name of *Monotis* simply. I now find these shells to be only the opposite valves of the same species, and, in well preserved examples, both valves to be radiately as well as concentrically striate. More than this: these additional specimens have convinced me that the form, although a genuine *Aucella*, and therefore still of great interest, is not, as I had previously conceived, undescribed. It is none other than the *Avicula Hughendenensis* Etheridge (*loc. cit.*, pl. 25, f. 3.), but the figure given in my father's paper does not convey a correct idea of the outline. Under these circumstances, therefore, the specific name will be *Aucella Hughendenensis*, Etheridge, sp. To the description given above, the following additions and corrections must be made. Both valves are crossed by fine radiating striæ, which give rise to a minute cancellation. In the left valve the striæ are more apparent below the beak, and die out on the body of the shell. In the right valve they are of a fluctuating or wavy character, and the concentric laminæ become frill-like.

[1] Trans. Geol. Soc. P. ter. iv, t. 11, f. 3.
[2] Pal. California ii, t. 32, f. 92.

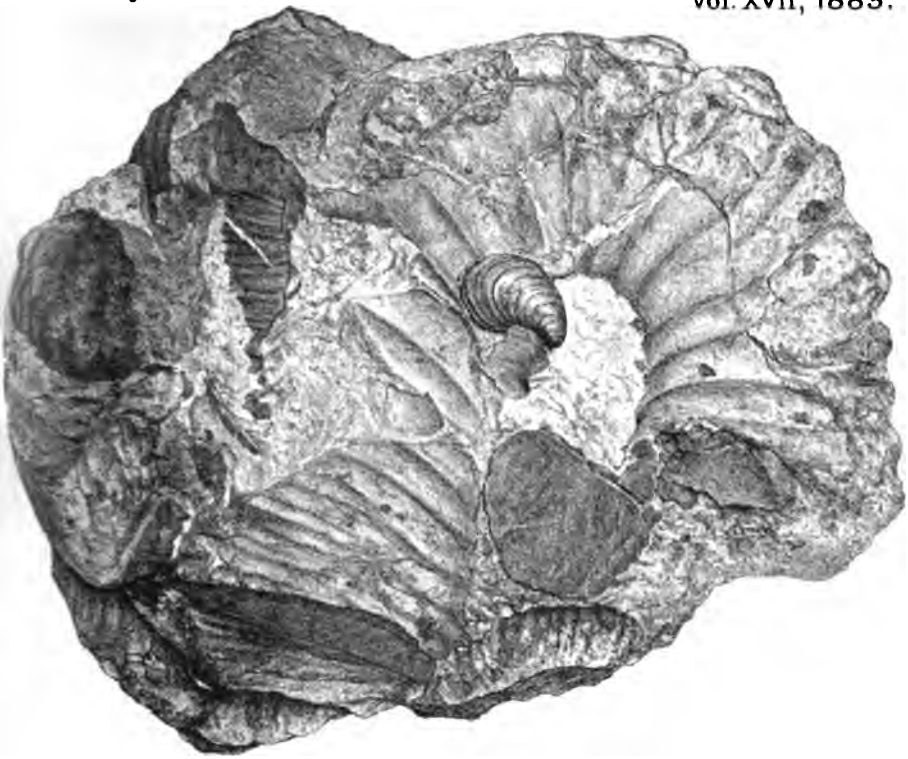
[Two plates.]

Inocerarnus Marathonensis



CRETACEOUS FOSSILS. QUEENSLAND.

S. T. Leigh & Co. Lith. Sydney



Ancyloceras Flindersi? and Aucella Liversidgei.

Ancyloceras?

Aucella Liversidgei

CRETACEOUS FOSSILS. QUEENSLAND.

S. T. Leigh & Co. Lith., Sydney

On Plants used by the Natives of North Queensland, Flinders and Mitchell Rivers, for Food, Medicine, &c., &c.

By EDWARD PALMER, Parramatta, N.S.W.

[*Read before the Royal Society of N.S.W., 1 August, 1883.*]

THE aboriginals appear to be possessed of considerable knowledge of indigenous plants and their uses in their several districts, as well as the periods of their flowering and fruiting; they also use many for their supposed medicinal qualities; and, considering that nearly half of their daily food consists of roots and fruits, it is no matter for surprise that they should possess some knowledge of plants. But apart from their interest in them for food purposes, they have names for a great number of plants which they do not use, and are familiar with the habits of nearly all the vegetation of their particular district.

This knowledge is likely to die out with them, unless some means are taken to place on record such information as can be gathered in the present day. The following list has been collected personally, and the names and manner of using them have been obtained from the natives themselves, and from personal observation and experience of them in their daily life—principally in the Bourke and Cook district of North Queensland, where the natives are still in their primitive or original state.

The list includes 106 plants for the first part; and about fifty more are known, but which are not determined yet, the season not being favourable for collecting them in seed or flower.

The naming of the different species has been given by Baron F. von Mueller and Dr. Woolls, and Mr. F. M. Bailey, from specimens forwarded.

Plants used by the natives of North Queensland, Flinders and Mitchell Rivers particularly, for food purposes.

1. *Acacia bidwillii*, Bentham F. Aus., vol. ii, p. 420. Native name on Cloncurry, "Yadthor." A soft-wooded tree, 20 feet high, with drooping branches; grows on the plains on the Flinders and Mitchell; leaflets small and numerous, fifteen to twenty pair, pendulous. Young trees thorny. The roots of young trees roasted for food after peeling. There are two varieties very much alike.

2. *Acacia decora*, Reichb., and *A. homalophylla* (gidya tree). The gum from these is gathered and eaten.

3. *Acacia farnesiana*, Bentham. (LEGUMINOSEÆ.) Native name on Cloncurry, "Bunkerman." A perennial shrub with many branching stems, growing up to 12 feet high on all the Flinders plains. Small pinnate leaves, and yellow blossoms with a strong sweet scent; branches very thorny; pods 2 inches long, round (filled with a pithy substance in which the seeds lie); roasted.

4. *Acacia pallida*, F. v. M. Native name in Cloncurry "Yadthor." A tall tree with drooping foliage. The roots of the young trees are roasted and eaten.

5. *Adenanthera abrosperma*, F. v. M. Native name on Mitchell, "Oon-doo." Tree 20 to 25 feet high, rough hard bark, pinnate leaves. Pods 5 to 6 inches long; seeds red and black, shining, and very hard; roasted on the coals and the kernels eaten. Grows in sandy poor country from the Gilbert to the coast.

6. *Albizzia monilifera*, F. v. M. Native name on Cloncurry, "Mullar." A spreading, bushy tree, found near water-courses or dry swamps near Normanton and Lower Mitchell, deciduous, bright green foliage. Pods, several inches long, are roasted when young and eaten by natives; also a beautiful tree.

7. *Ammannia multiflora*, Flora Aust., vol. iii, p. 298. (LYTHRARIÆ.) Native name on Cloncurry, "Jerry-jerry." Small annual plant, growing a few inches high, erect and branched. Grows among the grass in the billybongs of the Cloncurry River, with numerous, small, red seeds. The whole plant is gathered and ground with the feet on the ground, to separate the woody parts; it is then winnowed, and ground up with water on flat stones, and baked as a cake.

8. *Aponogeton sp.* Native name on Cloncurry "Tharndoo." Small aquatic plant in shallow lagoons, in Cloncurry and Mitchell Rivers. Leaves oblong, floating; flowers small and yellow. Bulbs spherical, 1 inch in diameter; eaten raw and roasted.

9. *Avicennia tomentosa*, R. Br. Mangrove, a small tree grows along saltwater creeks and swamps. Leaves pale green above, and white tomentose underneath. The tree grows plentifully in tidal waters in the Gulf. The fruit is baked or steamed in hollows made in the ground, in which they make fires; then taken out, and soaked and baked in the ashes.

10. *Barringtonia careya*. (CAREYA AUSTRALIS.) F. v. M. Native name on Cloncurry, "Go-onje" and "Gunthamarrah"; on the Mitchell, "Ootcho." Tree in open forest country between the

Saxby and Endeavour Rivers very common, sometimes 20 feet high. Leaves broad, and gathered in a cluster at the end of the small branchlets; flowers conspicuous, white, with base of stamens pink, opening during the night-time; they have a disagreeable heavy smell. Fruit large, with the calyx adherent; eaten when ripe.

11. *Bauhinia carronii*, Fl. Aust., vol. ii, p. 296. (LEGUMINOSEÆ.) Native name on Cloncurry, Myappe tribe, "Pegunny"; native name on Cloncurry of Mycoolan tribe, "Thalmera." A branching, shady tree, with roundish oval leaves growing in pairs, deciduous. Grows on the Flinders and Mitchell, and all through intervening country; abundance of scarlet flowers appearing before the foliage. The flowers have a clear honey secreted, which is squeezed out by the fingers and sucked; they also place the flowers in water and drink the mixture. A very pretty shade tree, branching very much.

12. *Boerhaavia diffusa*, Linné. F. Aus., vol. v. Native name on Cloncurry "Goitcho." (NYCTAGINEÆ.) A spreading prostrate viscid herb; leaf heart-shaped, small; flowers small, pink. The root is a long thin glutinous yam, 15 inches long, straight; grows on sandy banks of rivers, and on sand ridges, on the Cloncurry and Flinders. Roots roasted whole and eaten, of a mealy sweetish taste, and very nourishing.

13. *Caladium macrorrhizon*, Vent. A strong herbaceous plant, with large sagittate leaves. Found in moist, shady places, near scrubs or creeks. The young bulbs, of a rose colour, are baked in the ashes, and pounded on a log or stone; the same course being repeated till the mass is hard or fit to eat. The leaves and bulbs are very hot to the taste.

14. *Capparis lasiantha*, R. Br. in D.C., Prod. i, 247. Native name on Cloncurry "Wyjeelah" or "Thulla-Kurbin." A woody climber, growing on trees; stems sometimes 3 to 4 inches; leaves narrow oblong, or lanceolate, about 2 inches long, alternate, thick and fleshy; small white flowers; fruit oblong, turns yellow when ripe and splits lengthwise, exposing numerous black seeds embedded in a bluish pulp; sweet to the taste; the outer skin hot and bitter; flowers and fruits after the first thunder-showers in October. Grows all over the Flinders and on the Mitchell Rivers.

15. *Capparis lucida*, R. Br. (CAPPARIDEÆ.) A dark green shrub; grows on the Mitchell and Lynd Rivers; buds erect, fruit drooping, ripe fruit eaten.

16. *Capparis mitchellii*, Lindley. Native name on Cloncurry, "Karn-doo-thal." Dark green shrub growing on the plains and billybongs of the Cloncurry; about 12 to 15 feet high;

a rough and crooked stem, with the bark fissured longitudinally; large white flowers; fruit 2 to 3 inches in diameter, with a rough exterior rind; eaten raw when ripe. This is the large pomegranate common all over Queensland.

17. *Capparis spinosa*, var. *nummularia*, F. v. M. Native name on Cloncurry, "Longullah" and "Mijar." A low glabrous shrub, with hard tortuous branches, grows 3 to 4 feet high; leaves broadly ovate, alternate, with two thorns on each side, recurved; peduncles axillary; flowers large and showy, sometimes red or pink, often white, stamens very numerous; fruit larger than a pigeon's egg, yellow when ripe, eaten raw. This plant is often found round habitations, stockyards, or sheepyards, on the Lower Flinders and Cloncurry. Flowers in September.

18. *Carissa brownii*, F. v. M. Native name on Cloncurry "Kunkerberry." A prickly branching shrub, 5 to 6 feet high; small white flowers. Fruit a reddish small drupe, oblong, ½-inch long; grows in great quantities after the wet season on pebbly ridges on the Cloncurry in February. Gathered in quantities and eaten raw; quite sweet.

19. *Cochlospermum*, sp. Native name on the Mitchell, "Kurrutcha." A peculiar thorny tree, with large palmatifid leaf, growing in a cluster or crown near the top. Stem erect, covered with short broad spines or thorns; grows 10 to 12 feet high on the banks of the Mitchell in good soil; has a disagreeable smell. The roots of the young trees, which are long and thick, are roasted, when the skin peels off, leaving the edible part white and delicate and well-flavoured.

20. *Cucumis acida*. Tarquin. Native name on Mitchell, "Ghe-witcha." Very similar to *C. pubescens*, but smoother and free from bristles. Grows in scrubs and shady places on the Mitchell. Fruit similar but darker in colour and smooth, ripens after the wet season; flowers yellow.

21. *Cucumis melo?* Native name on Cloncurry "Binjy Binjy." A small wild melon, growing on the plains among the grsss. The size of a walnut, striped; eaten raw. Very common after wet seasons. Several other varieties of small melons grow during the wet season, which are all eatable.

22. *Cucumis pubescens*. (CUCURBITACEÆ.) Native name on Cloncurry, "Boomarrah." The small cucumber, grows on the plains among swamps and grass. Small yellow flower; stem and leaves covered with short hard bristles; fruit 1½ inch long, and ½ to ¾ inch in diameter, speckled, pale green and white, or striped and white, underneath. Grows in great quantities after the wet season, remaining sound for months after the small vines have entirely disappeared. The natives roll the stalks and

fruit on the ground to free them from their hairy covering: they bite off one end and press the pulpy substance and seeds into their mouth, and throw away the outer rind, which is bitter; also used roasted. The fruit is made use of by the whites.

23. *Cycas media*, R. Br. A graceful palm, with a crown of fruit growing at the base of the leaves, consisting of round, smooth nuts, the size of a walnut. Tree from 12 to 16 feet high, very common on the coast near Cooktown. The kernels of the nuts are poisonous, unless prepared by water and fire. After breaking them up and drying them, they are placed in a dilly-bag in water for several days, to extract the bitterness; the product is then hammered or pounded for some time, and subject to several courses of roasting and pounding before being fit to eat The blacks in Wide Bay used the nut in this way. James Morrill, the shipwrecked sailor, mentions that the natives about the Burdekin River used them in a similar manner. White men have suffered very much from accidentally or ignorantly using the nuts of *Cycas media*.

24. *Cymbidium canaliculatum*, R. Br., Prod. 331. F. Aus. vol. vi. (ORCHIDEÆ.) An orchid growing in the hollows of trees, with fleshy drooping leaves, 1 foot long, and a handsome scarlet hanging flower. The tubers of this plant are used by the blacks in Wide Bay, and by other coast blacks in the North.

25. *Cynanchum floribundum*. R. Br. Prod. (ASCLEPIADACEÆ.) Native name on Cloncurry "Thooromia." A woody annual plant, erect, 2 to 3 feet high; leaves lanceolate, opposite; flowers small; pods 1½ inch long, triangular pointed or tapering to a point, yellow when ripe, and full of fine cotton and small seeds, growing in pairs, flat sides, opposite, terminal on small branchlets; pods and leaves full of milk, eaten raw when young. It is said to fatten the natives.

26. *Dioscorea transversa*. R. Br. (DIOSCORIDEÆ.) A yam of large size, something like a sweet potato; grows in the scrub in the Cook district, about King's Plains, Normanby and Mitchell Rivers. The vine climbs to the tops of trees in the scrub, the seeds gathering in large clusters; a thin light seed, like brown paper. The roots grow among rocks in the crevices where rich soil is to be found. Mostly eaten raw, larger ones roasted.

27. *Dioscorea sativa*, Frag., vol. ii, p. 73. Native name on the Mitchell, "Karro." A strong-growing annual vine, grows on the trees on the Mitchell and Lynd Rivers; very abundant in the wet seasons. Large heart-shaped leaf and small pendant flowers. Has numerous large tubers with hairy like roots from all sides, very bitter. They are gathered and stored in sand about their old camps. When using them the tubers are first roasted, then

broken in water and strained through fine bags into large bark troughs full of water, and washed for hours, running the water over the sides of the pliant troughs as it gets discoloured, and stirring the yellow fecula with the hands. When sufficiently washed, round basins are made in the sand and lined with soft clay and sand, into which the product is poured; when much of the intermixed water held is drained away, leaving the food fit for use, and looking very much like maize hominy. Leichhardt speaks of finding these tubers in the blacks' camps, on page 284, and finding a difficulty in using them owing to their intense bitterness.

28. *Enchylæna tomentosa.* R. Br. (CHENOPODIACEÆ.) Native name on Cloncurry, "Kooloo-loomoo." A small, spreading, tender, perennial shrub, growing all over the plain country on the Flinders. About 2 feet high, frequently growing under the shade of other trees. Numerous fine fleshy leaves 1 inch long, pale green. Fruit, a red berry, small and flat, quite sweet, but not numerous; eaten raw. This is one of the salt-bushes.

29. *Entada scandens*, Benth. A strong climber, pod 3 to 4 feet long, and 4 inches broad; the seeds are 1½ to 2 inches in diameter. Grows on the Endeavour River and generally near the coast. The beans are first roasted or baked in ovens, then pounded, put in a dilly-bag, and left for ten or twelve hours in water, before they are fit to eat.

30. *Encephalartos miquelii*, F. v. M. "Dwarf Zamia." Grows on stony ridges, a few feet high, along the coast near Cooktown, and through the Wide Bay district. Bears a large cone fruit, not unlike a pine-apple. The seeds, when ripe, are orange red; they are baked in the ashes first, and the kernels are soaked in the water for several days, and being pounded and roasted, experience tells them when they are fit for eating.

31. *Eugenia suborbicularis*, Bentham. F., Aus. vol. iii, p. 285. Native name on Mitchell, "Oloorgo." A large tree, 30 to 40 feet high, called plum tree, with smooth brown bark. Leaves large and broad, gathered in clusters at the end of small branchlets; large white flowers, with numerous pendant stamens; fruit large, and red, with small stone inside; eaten when ripe. Grows in sandy country, in open forest, between the Lynd and Endeavour Rivers.

32. *Eucalyptus terminalis*, F. v. M., F. Aus., vol. iii, p. 257. Native name on Cloncurry, "Narm-boon-bong"; on Gilbert it is "Kulcha." A bloodwood tree, with reddish, scaly bark on trunk, smooth and paler on the limbs, grows 30 to 40 feet high. Large seed-vessel. Manna is procured from the leaves and small branches by being gathered and laid on pieces of bark, when the

particles of sugar or gum fall off, or are scraped off with mussel-shells into a kooliman (bowl), or the leaves when covered with the white exudation are pounded together with a stone and roasted in the ashes. Sometimes the sugary particles are gathered as they fall from the trees. After the rainy season this food is said to be abundant.

33. *Ficus aspera*, R. Br. The small fig-tree with rough leaves grows in a dense, bushy scrub on the banks of creeks and in sandy country, on the banks of the Cloncurry and Mitchell Rivers; very common, where it bears vast quantities of small black fruit; eaten raw.

34. *Ficus sp.* Native name on Mitchell "Orbolo" and "Coomey." A dark green shady tree, 16 to 20 feet high; with smooth oval leaf, broad, alternate, dark green; bears a small fruit; eaten raw. Grows on the bank of the Mitchell in good soil.

35. *Ficus vesca*, F. v. Mull. A large tree, grows 40 to 50 feet high, on the banks of the Mitchell and most coastal rivers. Leaves ovate, lanceolate, acute, dark green above, pale green underneath, smooth. The fruit when ripe turns pink or reddish, and hangs in clusters from the trunk, and on some of the largest branches.

36. The galls growing terminal on young trees of *Eucalyptus tetrodonta* and *E. corymbosa* are used. They are 2 inches or more in diameter, and contain either a small grub or a small transparent bag of jelly-like substance called "Kurcha," on the Mitchell and Cloncurry Rivers.

And several species of small melons grow in the plains after wet seasons.

37. *Grewia polygama*, Roxburgh. (TILIACEÆ.) Native name on Cloncurry, "Kooline." A perennial woody plant, 1 to 2 feet high; grows among the grass on ridges on Cloncurry and Mitchell and all over North Queensland. Leaves large, alternate, serrated, ovate, strongly veined, 2 inches long; berries brown or reddish, dry and smooth, two or four in an axillary peduncle. Called emu berries; eaten raw.

38. *Hibiscus divaricatus*, Fl. Aus., vol. i, p. 212. (MALVACEÆ.) Native name on Cloncurry, "Ngar-golly"; native name on Mitchell, "Ithnee." Annual plant, grows from 6 to 9 feet high, with soft prickles; stem erect and rough; leaves of two kinds growing on the same plant—one long, narrow, lance-shaped, with serrated edges, the other three-lobed, acute, broad at the base; flowers large, red and yellow, opening in the evening. The young buds are eaten raw, and the thick root is peeled and the skin eaten raw, which has a pleasant juicy taste. Grows on the sandy banks of the Cloncurry and Mitchell, and is called wild rosella.

39. *Hibiscus ficulneus*, Linn. D.C. Prod. i. 4, 48. Native name on Cloncurry, "Cooreenyan." An erect annual, 2 to 3 feet high. Few leaves, stem gummy and sticky, with a few short stiff hairs; flowers large and pink, petals towards the base beautifully red; capsule oblong, fluted, and full of small black seeds; terminal on small branchlets. The stem and root of young plant roasted in the ashes; eating like potato, and very nourishing. Grows on all the plain country on the Lower Flinders and Herbert Rivers after the wet season.

40. *Hibiscus pentaphyllus*, F. v. M. Native name on Mitchell "Inneeidne." A small shrub, 2 feet high, palmatified leaf; found on the sandy banks of the Mitchell; large white flower. The young buds are eaten raw.

41. *Ipomæa turpethum*, R. Br. Prod. 489. (CONVOLVULACEÆ.) Native name on Cloncurry, "Kar-Kor." A strong-growing vine, annual, grows over shrubs and small trees. Leaf 6 to 8 inches broad, smooth and shining. A large white flower. The seeds are large and black, enclosed in a transparent skin, generally three or four, smooth, with the angles rounded. The young buds are eaten raw when the seeds are white; they are very plentiful after the wet season, and are gathered by white people and boiled for peas. Grows all over the plains after rains, on the black soil plains.

42. *Limnanthemum crenatum*, F. v. M. A small water plant, with fringed yellow flower, heart-shaped leaf, serrated; floats on the water in shallow lagoons. The small round tubers are roasted for food.

43. *Loranthus exocarpus*. Behr. (LORANTHACEÆ.) Native name on Cloncurry, "Thappin." The mistletoe of the whitewood tree, *Atalaya hemiglauca*. Grows in heavy masses. Leaves opposite, cuneate, and irregular shaped; flowers red, and yellow sometimes, narrow, thin, and long; fruit an oblong pointed drupe, about half an inch long, with a soft stone, ripening yellow or transparent, gummy and sticky, sweet-tasted, and eaten raw. Fruits in September.

44. *Loranthus longiflorus*, (Desr). The mistletoe of the *Acacia bidwillii*; grows in large masses from the branches; has a yellow flower and large drupe. Sweet-tasted; eaten raw. Found all over the Flinders Plains. Pretty scarlet flowers.

45. *Maba humilis*, R. Br. (EBENACEÆ.) Native name on Cloncurry "Thankoin" and "Mogiore." A dark green shady tree, 20 to 25 feet high; grows in sandy forest country, or along the banks of creeks; leaves smooth, alternate, oval, about 1 inch long; yellow oval fruit $\frac{3}{4}$ of an inch long, growing in the calyx, very abundant on each tree; eaten raw.

46. *Nelumbium speciosum*, Willd. The pink water-lily. From Indian name, Nelumboo, the sacred Lotus. A splendid aquatic plant, with a large floating leaf 1 to 2 feet in diameter, peltate and slightly concave. Large pink flowers, 5 to 8 inches across. The seeds are embedded in a flat-topped torus—from twenty to thirty-five; they are broken with a stone, and eaten raw. Grows on the coast country, in large permanent lagoons, near King's Plains, Cooktown, also near Rockhampton.

N.B.—Besides Australia, this plant inhabits China, Japan, the Malay and Philippine Islands, Persia; and has been worshipped in many places besides Egypt. A better description of the fructification can scarcely be given than that of "Herodotus," who compared it to a wasp's nest. Endlicher says that the milky viscid juice of the flower-stalks and leaf-stalks is a remedy in India against sickness and diarrhœa. The petals of the flower are also stated to be astringent. The flower is supposed to be the Lotus figured on Egyptian and Indian monuments, and the fruit is said to be the "Pythagorean Bean." It is the sacred bean of India. The plant is said to have disappeared from the Nile, where it used to abound.

Nelumbiun leichardtii is the sacred bean of N. E. Australia.

47. *Nymphæa gigantea*, Hook. The blue water-lily. Native name on Mitchell "Arnurna." Large broad leaf, floating on the surface of the water, green on the upper and blue on the under surface, with prominent reticulations on the under part of the leaf. Flowers large and bluish, or blue, or white—grows in large lagoons on the Mitchell and Norman Rivers. The porous seed-stalk is peeled and eaten raw, also roasted, as well as the the round seed-head, making a distinction between those containing brown or black seeds, rejecting those with light-coloured seeds. The large rough tubers growing in the mud with the floating leaves attached are roasted, being not unlike a potato, but yellow and dry when cooked. On the Mitchell River the roots are called "Thoongon," the seed-stalk "Urgullathy," and the round seed-head "Irrpo." On the Cloncurry, the Mycoolon tribe call the tubers Thindah, the stalk Thoolambool, and the seed-head is "Mille."

48. *Oryza sativa*, Linn., indigenous (rice of commerce). Native name on Cloncurry "Kineyah." A tall grass, 4 to 6 feet high, called wild rice; grows during and after the wet season on all the plains and swamps all over the Gulf country. It soon dries, and bends over or breaks. The seeds are large, with flat husk and a long awn or beard. The heads are gathered before the seed falls, and then threshed out on a flat stone. The seeds are then broken and winnowed, to separate the husks and beards from the eatable part, which is then ground between two stones with water, and roasted.

49. *Owenia acidula*, F. v. M. Found on stony ridges principally; a shrub or tree 20 feet high, very shady, erect trunk and glossy pinnate leaves. Bears a dark red or crimson fruit, eatable part (*sarcocarp*) red, eaten raw, very acid. On Cloncurry ridges.

Spondias pleiogyna, F. v. M., is a similar tree, and grows in a like manner, called sweet plum. Fruit eaten raw.

50. *Pandanus aquaticus*, F. Aus., vol. vii, p. 148. Native name on Mitchell, "ă-Kōō." A species of palm, with spiral leaves; grows in sandy country, generally from the Flinders to the coast, particularly along the banks of small sandy creeks. The strong leaves are armed with three rows of sharp spines, and the stem throws out several branches, and sometimes aerial roots. The fruit is a large cone, orange red when ripe, consisting of numerous hard nuts imbedded or attached to a rachis, which are broken off and held close to the fire, facing it, when the inside kernel is drawn out, or extracted, and eaten. The soft part of the nut where it adheres to the stalk is used. These broken nuts are to be seen in great numbers round their old camp fires in the sandy country between the Gilbert and the Palmer.

51. *Panicum decompositum*, R Br. Native name on Cloncurry "Tindil." The "umbrella" grass; grows on all western country, with a fine branching seed-head and broad leaves, about 2 feet high. Found on Cloncurry plains. The seed-top breaks off when dry, and is driven by the wind across the plains. Has a fine yellow seed like lucerne seed, which is gathered when the seed is just opened from the sheath. It is winnowed and ground between two stones, mixed with water into a kind of paste or thick gruel, and poured into the hot ashes; making into a sort of damp bread, very nourishing and satisfying.

52. *Parinarium nonda*, Flora Aus., vol. ii, p. 426. A large shady tree, growing in sandy forest country, from the Saxby River to Cooktown, 30 to 40 feet high, with spreading branches, foliage drooping, flowers small. Fruit 1½ inch long, yellow when ripe, with a dry mealy taste, rather rough in the mouth; a small rough stone. Fruit eaten by natives when ripe, also by emus.

53. *Persoonia falcata*, R. Br. (PROTEACEÆ.) Native name on Mitchell, "Nanchee" and "Booral." Shrub or small tree, 8 or 12 feet high, of a crooked growth. Bark soft, scaly, reddish on the trunk and base, smoother in the limbs. Leaf alternate, long, narrow, and pendant, thick and coriaceous. The flowers yellow, and fruit green, pointed and oblong, ¾ inch long, eaten raw. Grows in poor, sandy, country, between the Saxby River and the coast towards Cooktown.

54. *Physalis minima*, L. (SOLANACEÆ.) Native name on Cloncurry, "Neen-gwan." A native gooseberry, annual, spreading, and bushy, about 2 feet high, leaf soft, acute, small white flower; stems reddish, triangular; fruit light yellow, in an inflated calyx, similar to the Cape gooseberry. Grows in sandy ground on the Upper Cloncurry.

55. *Polygonum hydropiper*, Linn. (from its English name, "Water-pepper"). Native name on Cloncurry "Booragoorah." Found in shallow lagoons, with a long trailing stem, common also in N.S. Wales; leaves very hot to the taste. The coarse stalks are roasted, peeled, and eaten by the natives on the Flinders.

56. *Portulaca oleracea*, Linn. Native name on the Cloncurry, "Thukouro." The common pigweed or portulac; grows after the wet season on the banks of rivers and on sand ridges in great quantities. The stalks are roasted in the ashes, which softens them, then eaten; also eaten raw. The plant is gathered in heaps and, after drying a little time, the seeds fall off and are gathered with mussel-shells, ground between two stones and roasted.

N.B.—One would suppose that so small a seed would scarcely repay the labour of collecting, but the natives obtain large quantities by pulling up the plant, throwing them in heaps, which, after a few days, they turn over, and an abundant supply of seed is found to have fallen out, and can be easily gathered up. The food prepared from this seed is said to be highly nutritious. The ancients considered the seeds, steeped in wine, to be emmenagogue. The seeds are said to be used as a vermifuge, and to be used in cases of dyspnæa and mucous disorders. Used in India by native doctors internally in spitting of blood.

57. *Santalum lanceolatum*, R. Br. (SANTALACEÆ.) Native name on Cloncurry, "Tharra-gibberah." Tree grows to 20 feet, sometimes tall shrub, drooping branches. Leaves lanceolate, opposite, 1½ inch long; flowers small and white, flowering in September; fruit, a brown or black drupe, oblong, of a sweet taste, and the size of a small plum. Grows all over the Flinders country around the Gulf.

58. *Sarcocephalus leichhardtii*, F. v. M. A large tree, growing in scrubs along the banks of rivers, 40 feet high or more, a beautiful shade tree, wood yellow and bitter, called the Leichhardt tree. Leaves broad, oblong, very glossy, deciduous. Flowers globular and fragrant. Fruit 1½ to 2 inches in diameter, spherical, soft when ripe, the pulp slightly bitter; eaten raw. Native name on Mitchell, "Oolpanje"; on Cloncurry, "Coobiaby." Grows on the Gregory River, and Mitchell and other rivers; fruits during wet season.

59. *Securinega obovata*, F. v. M. Native name on Cloncurry, "Tharginyah;" on Mitchell, "Arrimby." Shrub with numerous straight stems, about 6 or 7 feet high, wood pithy and brittle. Leaves alternate, entire, oblong, pale green, surface rough, lighter colour under surface; fruit small and white, in great quantities; the natives gather them in bark koolimans to bring into camp; about the size of flat peas, sweet and juicy, eaten raw, and ripens in November. Grows on all the country from the Cloncurry to the Mitchell, often along the banks of creeks.

60. *Solanum esuriale*, Lindley. (SOLANACEÆ.) Native name on Cloncurry, "Oon-doroo." Herb, annual, about 1 foot high, a few pale green leaves, soft, tomentose, alternate, stem erect. Fruit the size of large marble, yellow; grows among the tufts of grass on the Flinders plains, not very numerous; eaten raw and roasted. Sir Thomas Mitchell mentions this plant.

61. *Sporobolus lindleyii*. F. Aus., vol. vii. Native name on Cloncurry, "Yak-Ka-berry." A tender, delicate grass, 9 to 12 inches high, with very fine seeds and stalks. Grows on ridges on the Cloncurry; not very common. The fine seeds are gathered and ground up with water into a paste, and baked in the ashes.

62. *Sporobolus indicus*, F. Aus., vol. vii. Native name on Cloncurry, "Jil-crow-a-berry." A fine grass, about 9 to 12 inches high, on pebbly ridges on the Cloncurry, generally near scrubs of *Acacia homalophylla*. The stalks are steeped several hours in water, when the seeds are easily rubbed out, and then ground between two stones and baked for bread. Wherever this grass grows in N. Queensland the natives use it in the same manner.

63. *Sterculia rupestris*, Benth. The bottle-tree, also called Kurrijong tree; grows mostly over all North Queensland. The roots of the young trees are eaten.

*64. *Terminalia platyphylla*, F. v. M. Native name on Flinders, "Durin." A large shady tree, 30 to 40 feet high; leaf large, 4 to 6 inches long; a rough bark, broken into small squares; wood hard and tough. Small fruit, oblong, pointed, blue when ripe; eaten raw. Grows in or near water-courses on the Cloncurry, Gilbert, and Mitchell Rivers.

65. *Trichosanthes palmata*. F. Aus., vol. iii. (CUCURBITACEÆ.) Native name Cloncurry, "Thowan." A coarse climbing vine,

* *Terminalia* sp. Similar tree, but smaller; grows on dry ridges near the Carron and Saxby, with fine large blue plums, good to eat. Fruits in August very plentifully.

growing on the tallest trees in open forest, by means of tendrils, stout stem, reddish. Bears a large yam or root, several feet deep, roasted and eaten.

66. *Typha angustifolia*, F. Aus., vol. iii. (TYPHACEÆ.) Common reeds found in water; the stems are used for reed spears, and the young leaves and roots are edible.

67. *Typhonium angustilobium*. F. v. M. (AROIDEÆ.) Native name on Mitchell, "Wanjallo." A tuber, pink or flesh colour, of large size, with long fleshy leaves; growing on river flats on the Mitchell and Lynd Rivers, in good soil. The bulbs are roasted and broken with a stone; pounded a good deal, and roasted several times before using.

68. *Xanthorrhœa arborea*, F. Aus., vol. vii, page 115. The grass-tree grows on poor, stony ridges near the coast. The white tender base of the leaves are eaten, as well as the extremities of the young shoots. A small grub lives at the roots of this tree, which are considered a particular delicacy.

Some additional plants used by aborigines of Australia—principally Queensland:—

69. *Adansonia gregorii*. The boab-tree, met with between the Gulf and latitude 17° S., and near the Fitzroy. Grows singly, only two or three in sight at one time, deciduous, and from 12 to 30 feet high; stems very large and bulging in the middle; leaves digitate; flowers are pendulous, beautiful to look at, and of a pure white, and sweet-scented; the most useful tree in Tropical Australia for the aborigines. Many old encampments are found round a clump of the trees with remains of old husks. The fruit is about the size of an emu egg, with a thin woody shell or covering filled with a whitish flowery mass which is edible. Embedded in the flowery mass are from eight to a dozen kidney-shaped seeds the size of a bean. The natives bake these nuts or seeds and grind them, or eat them raw. The tree is similar to that called "gouty stem tree," by Sir G. Grey and Mr. Cunninghame (by J. Pentescost).

70. *Araucaria bidwillii*. Native name in Wide Bay "Bunya bunya." The large bunya tree, found originally in a mountainous district west from Wide Bay, in a tract of hilly country about 80 miles long and 40 wide, which was reserved for the use of the natives.

An annual crop of fruit is produced, but once in three years a much larger quantity grows, when the natives gather from distances over 200 miles at the fruiting season. The fruit grows in a large cone, and consists of numerous small-pointed nuts, sweet to the taste and very fattening.

71. *Banksia marginata*, Linn. Native name in Wide Bay, "Wallum." A stunted honeysuckle, growing in poor sandy country, north of Wide Bay, along the coast. The honey is sucked out of the flowers by the natives at certain seasons, by drawing across the mouth. They gather from all parts when the flowers are full, and are very partial to it.

72. *Eucalyptus oleosa*, F. v. M. The mallee scrub in back parts of New South Wales is mostly composed of this, which is a stunted shrub and thick-growing. The roots, which run along the surface, are dug up with sticks and cut into lengths to drain the water out by placing on their end in a wooden kooliman. The water is clear and good, and the natives get enough for all their wants in the desert where no surface water can be found.

Plants used for medicine, and to stupify fish.

73. *Barringtonia careya*, Roxb. Mentioned before as bearing an edible fruit; the bark of the root is used as a fish poison, beaten up fine. J. Morrell mentions the same of the blacks on the Burdekin; they used the bark of the stem to poison fish in fresh water, and the bark of the root for salt water.

74. *Barringtonia racemosa*, Blume. Native name on Mitchell, "Yakooro." Called fresh water mangrove. A spreading shrub or tree, sometimes 15 feet high; grows in or near water or shallow lagoons; has a pendant flower. Found on the Mitchell, Laura, and Lynd Rivers. The bark is cut up in small pieces and hammered on a stone fine and small before placing in water; fish are said to eat of it and turn up in consequence.

75. *E. microtheca*, F. v. M. F. Aus., vol. iii, p. 223. Native name on Cloncurry, "Jinbul or Kurleah." The Coolibar or flooded box found on all Gulf waters, often in flooded ground, of a crooked growth, about 30 feet high. The small branches are cut up, and with the leaves are laid in water for several days to sicken the fish; it is universally used for this purpose. The inside bark is beaten up and used as a poultice for snake-bites, heated.

76. *Eucalyptus pruinosa*, Schau, F. Aus., vol. iii, p. 213. Native name on Cloncurry, "Kullingal." The silver-leaved box; grows 18 to 20 feet high, of a stunted crooked growth, on spinifex or stony ridges. Leaves silver grey, covered with bloom, broad, sessile, opposite. The inside bark is stripped and wound round the chest and body very tightly, damped with water, for pains, rheumatism, &c., sitting down in the water at the same time.

77. *E. tetrodonta*, F. v. M., vol. iii, p. 260. Native name on Mitchell, "Olm-bah." Called a stringy-bark or messmate; found on Mitchell, Gilbert, and Norman Rivers, in sandy country;

straight upright growth, 40 to 50 feet high in forests. Pretty white flowers and large operculum. The leaves of the young trees are bruised and rubbed in water in a kooliman with the hands till the water is green and thick, when it is drunk for fevers and headache.

78. *Excœcaria parviolia*, F. v. M. Native name in Cloncurry, "Jil-leer." The gutta-percha tree; grows all over the Gulf waters, and also on the Mitchell River, often in country subject to floods. Erect stem, sometimes 20 feet high, with a rough, rugged bark, and small leaves gathered in clusters. Full of milky juice, very dangerous to the eyes. The natives use the bark mashed up in water in a wooden kooliman, and heated with stones from a fire close by. The wash is applied externally to all parts of the body, rubbing it in. Used for pains and sickness.

79. *Gnaphalium luteo-album*, Linn. Native name "Kar-kar." Annual herb, about 1 foot high; small yellow flowers; found mostly in the rivers and creeks or near scrubs on the Mitchell. Used medicinally for general sickness, as a drink.

80. *Heliotropium ovalifolium*, Forsk. Native name "Kar-kar," which seems to be a general name for medicinal plants. A small herb with yellow flowers, found in the rivers commonly. Bruised in water it is used as a drink and wash, the head and body being rubbed over with the dilution.

81. *Loranthus quandong*, Flor. Aus., vol. vi. The mistletoe of the gidya (*A. homalophylla*); hangs in clusters, with scarlet flowers. The leaves are bruised in water and drunk for fevers.

82. *Luffa ægyptiaca*, Mill, Dict. (CUCURBITACEÆ.) Native name on Mitchell, "Bun-bun." A vine growing in the bed of the Mitchell, Gilbert, and Ennasleigh Rivers; climbing into the tallest trees. Broad leaf, 4 to 6 inches across, and a large yellow flower. Pod 4 to 6 inches long, full of pulp and seeds, with a spiral thread. Used to poison fish when green.

83. *Melaleuca leucadendron*, Linn. Native name on Mitchell, "Atchoourgo." The large tea-tree; grows in the beds of all the rivers in the north of Queensland. The young leaves are bruised in water, and drunk for headache and colds and general sickness; the bark is also used for bedding to lay on the ground, and to form camps with. Cajaput oil is made from this same tree.

84. *Moschosma polystachium*, D. C. Prod. XII., 48. Fl. Aus., vol. v. An erect, slender, much-branched annual, nearly 3 feet high; slightly pubescent, stems acutely four-angled, strong-smelling. Grows on the Mitchell and Flinders in sheltered places, growing rankly. Used as a medicine by mixing in water, for fevers, &c

85. *Ocimum sanctum*, Linn. (LABIATÆ.) Native name in Cloncurry, "Mooda," on the Mitchell, "Bulla bulla." A fragrant shrub growing near scrubs of *Acacia homalophylla* (or gidya), on the Cloncurry. A branching stem, about 2 feet high; perennial, of a strong pleasant odour. The leaves are crushed up in water in a kooliman, and drunk for fevers and sickness. White people make tea of the leaves dried, called bush tea.

86. *Plectranthus congestus*, R. Br. (LABIATÆ.) Native name on Mitchell, "Kar-kar." A strong-smelling branching herb, 3 feet high, growing rankly on the banks of the Mitchell and Flinders. Leaves and branches crushed in water and drunk for internal complaints.

87. *Pterocaulon glandulosus*, Bentham. A strongly smelling herb, 2 feet high, with a rough decurrent leaf. The whole plant very scabrous. Used for medicine in fevers.

88. *Tephrosia sp.* (LEGUMINOSÆ.) Native name on Cloncurry, "Jerril'-jĕrry'." A small shrub, 2 to 3 feet high, found on sandy ridges on the Cloncurry, with a bluish appearance. Small dark flowers like a pea. Pods thin, 1 inch long. Leaves tapering to the stem. The plant is used to poison fish or stupify them; the whole plant is broken up and placed in small lagoons. *T. toxicaria* is said to be used as fish-poison in Africa.

Plants and trees used by the natives for manufacture of bags, cordage, and implements.

89. *Abutilon otocarpum*, F. Aus., vol. i., p. 202. Native name on Cloncurry, "Ballan-boor." Annual plant, straight stem, 6 to 7 feet high. Leaves soft and silky, pale green, acute, serrated, heart-shaped. Grows on sandy banks of the Cloncurry. The bark is peeled off, and scraped clean with mussell-shells, used for making strong netting for game.

90. *Acacia homalophylla*, F. v. M. Native name on the Cloncurry, "Wong-arrah." The gidya tree, a species of myal without the drooping foliage. Violet-scented dark wood; grows principally on pebbly ridges on the Cloncurry and Gulf rivers. The mistletoe is used for medicine. The wood is made into boomerangs, and is the favourite wood for spears. Some spears are found 12 and 14 feet long in one straight piece, not thicker than a man's finger, being very tough and free in the grain.

91. *Clerodendron floribundum*, R. Br. Native name on Cloncurry, "Thurkoo." A shrub 3 to 4 feet high, found on the banks of the Upper Cloncurry and other rivers. Large broad leaf, shining, opposite, acute, growing on a long petiole; small

white flower on a long peduncle; small green fruit, wood soft and pithy. Two dried sticks of this plant are used for drills to make fire with.

92. *Corypha australis.* Cabbage-tree palm, found on the Endeavour and Normanby Rivers in rich scrub soil. The wood is split and made into spear heads.

93. *Erythrina*, or coral tree. Produces a light spongy wood, which is used for shields.

94. *Erythrophlæum laboucherii*, F. v. M. (LEGUMINOSÆ.) Native name on Mitchell, "Ah-pill." Ironwood tree, round dark green leaves, with broad pod; grows on all sandy country from Cooktown to the Saxby River. Bark hard and rough. The wood is red-coloured and very hard, rather coarse-grained, and is used for wommeras for throwing spears with, and also for spear-points.

95. *Eucalyptus tetrodonta*, called stringy-bark or messmate. The tough bark, after being cleaned and stripped off, is made into troughs, tied up very neatly at each end, for washing karro in; tough and pliable.

96. *Hibiscus panduriformis*, Burm. (MALVACEÆ.) Native name on the Mitchell, "Bee-allo." A fibrous plant, with yellow flowers and large hairy seed-pods; grows 8 to 10 feet high. Short rough hairs all over the plant; grows on the Mitchell near scrubs. The bark is peeled off, cleaned and twisted into twine, and into bags for carrying roots, game, &c. The young leaves of *Pandanus aquaticus* are split and wove into dilly-bags, sometimes after steeping a little in water.

97. *Hæmodorum coccineum*, F. Aus., vol. vi. (AMARYLLIDEÆ.) Native name on the Mitchell, "On-tho." A perennial root, throwing out fresh leaves and shoots annually. Dark scarlet roots and fleshy, hard, narrow leaves, more than 1 foot long. Erect flowering seed-stalk, about 2 feet high. Grows on poor sandy country all through the Cook district. The leaves are made into fine bags to strain the karro meal through when washing. A fine strong fibre is found in the tough, drooping leaves.

98. *Panicum leucopheum*, H. B. et Kunth. (GRAMINEÆ.) A grass growing on the plains and ridges on the Cloncurry, about 12 or 15 inches high, in strong bunches, with matted roots. Leaves short and broad, partly sheathed. The fibrous under part of the leaf is peeled off when young, and twisted with the fingers as it is drawn off into a thread, and used to make twine.

99. *Panicum trachyrrachis*, Benth. Native name on the Mitchell, "Oo-kin." A tall swamp grass, 6 to 8 feet high, erect stem, numerous spreading branchlets covered with fine reddish seeds. Large broad leaves sheathed. The fibre is peeled from the under

surface of the leaf, by breaking it in the middle across with a sudden jerk while held between the fingers, and drawing the threads away. They are twisted up at once into twine.

100. *Phragmites communis*, Trin. The common reed, found in the bed of the Mitchell River; very large and tall. The stems are used for reed-spears. They are cut green, and stored in large quantities. When used they are straightened in the fire, and become very tough.

101. *Psoralea archerii*, F. v. M. Native name on Cloncurry, "Wommo," a fibre plant; grows along watercourses, about 2 feet high. Leaf acute, serrated, opposite, dark green, small purple flowers, a quantity of small green seeds along the stem. The plant is pulled, soaked some hours in water and left to dry, when the bark peels and is kept for use, for cordage and strong twine. Grows on the Cloncurry plains and billybongs after wet season.

102. *Psychotria, sp.* A shrub growing on the Mitchell banks and near scrubs. Pale green, soft leaf, opposite, 2 inches long, broad oval, small green fruit, flowers in small clusters; bark smooth. Two sticks of the same wood are used for fire-drills; the natives of the Mitchell carry two sticks of this shrub in a sheath ready for use.

103. *Sesbania ægyptiaca*, Persoon. Native name on Cloncurry, "Ngeen-jerry." Called peabush; grows in the beds of creeks and plains; an annual, with a yellow or lilac flower; grows from 5 to 7 feet high, with spreading branches. When dry the natives use two pieces of the same plant for fire-drills; stems are used for the ends of reed spears.

104. *Sterculia sp.* Native name on Cloncurry "Eendurah." A tall shady tree, called Kurrijong; seed-pods eaten after roasting. Inside bark worked up into strong cord for wallaby nets and bags.

105. *Thryptomene oligandra*, F. v. M. Native name on the Mitchell, "O-May." A small tree, called swamp ti-tree, grows in sandy country near swamps, on Mitchell and Gilbert Rivers. Small leaves growing alternate; small white flowers grow among the leaves at the extremities of the branchlets. Wood hard and fine, used for the points of spears—for reed spears only.

106. *Ventilago viminalis*, Hooker. (RHAMNEÆ.) Native name on Cloncurry, "Thandorah." Shrub, sometimes a tree 12 to 16 feet high; all over the North of Queensland, from the coast to the distant interior, growing in every soil. Long pendant leaves, 3 to 5 inches long. Wood soft and yellow, pithy. Crooked and straggling growth; bark rough and scaly. They use two sticks of the same wood from this tree for making fire with. It is generally used, and being common, is the most frequently used of woods for that purpose.

The following plants are also used by the natives for food in New South Wales:—

Macrozamia spiralis, one of the cycas family, and similar to one in Queensland.

Marsdenia viridiflora, of the asclepiad family, with very large tuberous roots.

Typhonium brownii, an "arum."

Canavallia obtusifolia, leguminous.

Castanospermum australe.

Xanthorrhœa hastilis.

Livistona australis.

Typha angustifolia, and tubers of orchids, also some sedges.

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Food plants.

No.

1. Acacia bidwillii, Benth., Fl. Aus., vol. ii, p. 420.
2. Acacia decora, Reichb.
3. Acacia farnesiana, Bentham.
4. Acacia pallida, F. v. M.
5. Adenanthera abrosperma, F. v. M.
6. Albizzia monilifera, F. v. M.
7. Ammannia multiflora, Fl. Austr., vol. iii, p. 298, Roxburg.
8. Aponogeton, sp.
9. Avicennia tomentosa, R. Br.
10. Barringtonia careya (Careya australis), F. v. M.
11. Bauhinia carronii, Fl. Austr., vol. ii, p. 296.
12. Boerhaavia diffusa, Linné, Fl. Aus., vol. v.
13. Caladium macrorrhizon, Vent.
14. Capparis lasiantha. R. Br. in D. C. Prod., i, 247.
15. Capparis lucida. R. Br.
16. Capparis mitchellii. Lindley.
17. Capparis spinosa, var. nummularia, Linn.
18. Carissa brownii, F. v. M.
19. Cochlospermum, sp.
20. Cucumis acida. Tarquin.
21. Cucumis melo.
22. Cucumis pubescens.
23. Cycas media. R. Br.
24. Cymbidium canaliculatum, R. Br. Prod., 331.
25. Cynanchum floribundum, R. Brown, Prod., 463.
26. Dioscorea transversa.
27. Dioscorea sativa, Frag., vol. ii, p. 73.
28. Enchylæna tomentosa. R. Brown, Prodr., 408, (1810).
29. Entada scandens, Bentham.
30. Encephalartos miquellii, F. v. M.
31. Eugenia suborbicularis, Bentham, Fl. Austr., vol. iii, p. 285.
32. Eucalyptus terminalis, F. v. M., Fl. Austr., vol. iii, p. 257.
33. Ficus aspera, R. Br.
34. Ficus, sp.

No.
35. Ficus vesca, F. v. M.
36. Galls, &c.
37. Grewia polygama, Roxburgh, F. L. Ind., ii, 588, (1832).
38. Hibiscus divaricatus, Fl. Aus., vol. i, p. 212.
39. Hibiscus ficulneus. Linn., D. C. Prod., i, 428.
40. Hibiscus pentaphyllus, F. v. M.
41. Ipomœa turpethum. R. Br. Prod, 485.
42. Limnanthemum crenatum, F. v. M.
43. Loranthus exocarpus, Behr.
44. Loranthus longiflorus, Desr.
45. Maba humilis, R. Br.
46. Nelumbium speciosum, Willd.
47. Nymphæa gigantea, Hooker.
48. Oryza sativa, Linn.
49. Owenia acidula, F. v. M.; also Spondias pleiogyna, F. v. M.
50. Pandanus aquaticus, Fl. Austr., vol. vii, p. 148.
51. Panicum decompositum, R. Br.
52. Parinarium nonda, Fl. Austr., vol. ii, p. 426.
53. Persoonia falcata, R. Br.
54. Physalis minima, L. sp. pl., 183.
55. Polygonum hydropiper, Lin.
56. Portulaca oleracea, Linné, spec., plant, 445, (1753).
57. Santalum lanceolatum, R. Brown, Prodr., 356.
58. Sarcocephalus leichhardtii, F. v. M.
59. Securinega obovata, F. v. M.
60. Solanum esuriale, Lindley.
61. Sporobolus lindleyii, F. Austr., vol. vii.
62. Sporobolus indicus, F. Austr., vol. vii.
63. Sterculia rupestris, Benth.
64. Terminalia platyphylla, F. v. M.
65. Trichosanthes palmata, Fl. Aus., vol. iii.
66. Typha angustifolia, Fl. Aus., vol. iii.
67. Typhonium angustilobium, F. v. M.
68. Xanthorrhœa arborea, Fl. Austr., vol. vii, p. 115.
69. Adansonia gregorii.
70. Araucaria bidwillii, Hook.
71. Banksia marginata, Linn.
72. Eucalyptus oleosa, F. v. M.

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74. Barringtonia racemosa, Blume.
75. Eucalyptus microtheca, F. v. M., vol. iii, p. 223.
76. Eucalyptus pruinosa, Schaur, Fl. Aus., vol. iii, p. 213.
77. Eucalyptus tetrodonta, F. v. M., vol. iii, p. 260.
78. Excœcaria parviflora, Mueller, in Flora, 433, (1864).
79. Gnaphalium luteo-album, Linn.
80. Heliotropium ovalifolium, Forsk.
81. Loranthus quandong, F. Aus., vol. vi.
82. Luffa ægyptiaca, Mill. Dict.
83. Melaleuca leucadendron, Linn.
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85. Ocimum sanctum, Linn., var. angustifolium.
86. Plectranthus congestus, R. Br.
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99. Panicum trachyrrachis.
100. Phragmites communis, Trin.
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102. Psychotria, sp.
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Notes on the Genus Macrozamia.

By CHARLES MOORE, F.L.S., Vice-President of the Royal Society of N.S.W., Director of the Botanic Gardens, Sydney.

[*Read before the Royal Society of N.S.W., 5 September, 1883.*]

THE object of this paper is to furnish (principally from personal knowledge) a brief general historical sketch of the species of the genus Macrozamia, with a description of those known to inhabit this Colony up to the present time. The plants of this remarkable genus, which is purely Australian, were, until a recent period, but very imperfectly known; of at least fourteen well-marked species discovered from time to time in various parts of the eastern side of this our island continent, only four have been fully described in that invaluable work, the *Flora Australiensis*, published in 1873. As I am perhaps better acquainted with the plants of the genus which are found in this Colony than any other person, having either discovered them myself or had them collected for the first time through my agency, the information which I shall now proceed to furnish regarding the different species may prove to be of some botanical interest. In Robert Brown's *Prodromus*, one of the first and best works so far as it went on the plants of Australia, only one species is described, and that under the name of *Zamia spiralis*, giving as habitats for this plant the very distant places of Sydney and King George's Sound in Western Australia.

It is not at all surprising that these plants found growing so far apart should have been considered to be identical, as both are very similar in every respect, but they are now regarded as perfectly distinct species, the western plant being named *Macrozamia Fraseri*, Miq., and our eastern or Sydney plant is still called by the original specific designation of *spiralis*, an absurd specific name it must be confessed now that the remarkably spiral characteristics of other species have become so well known. So far as my knowledge extends, it was not until the year 1854 that any other than the two first-mentioned species of the genus were known to exist in this part of the world. In that year, while travelling in Queensland, a narrow-leaved species was observed by me between Maryborough and Gayndah, now in cultivation here, and since sent by various persons to Europe as *M. tenuifolia* and *M. plumosa*, and published in the *Flora Australiensis* as *M. Paulo-Gulielmi*, F.M.,

and much further north, between Gayndah and Port Curtis, another new species was noticed, in general appearance and similar in size to *M. spiralis*, but with bright yellow nuts, which at once distinguished it from that plant. This species is described in the *Flora Australiensis* as *M. Miquelii*, and is very abundant in many localities in Queensland, one being well known as Zamia Creek. Subsequently to this, Mr. Hill, the late Director of Brisbane Botanic Gardens, discovered in Queensland two or three other species, to which he gave provisional names; but of these, unfortunately, no descriptions have been published, although from the specimens of the leaves of those which I saw in that gentleman's possession some years ago, I had every reason for thinking that they were all very distinct and undescribed species. One of these, named *M. Hopei*, in compliment to the Honorable Lewis Hope, which I have had here in cultivation for some years, is undoubtedly a new and noble species, approaching somewhat in appearance to, but more rigid in habit than, *M. Denisonii* or *Perowskiana* of the *Flora Australiensis*. It is to be hoped that Mr. Hill will yet furnish all the information which he can respecting these plants, and that either he or some other botanist will collect ample material of all these and furnish descriptions of them; until this is done, our knowledge of those northern species of this genus must necessarily remain very incomplete. I would add, before leaving this part of the subject, that within the last year or two Baron von Mueller has published descriptions of two previously unknown species peculiar to Queensland, one of which he named after myself, the other in compliment to the Hon. John Douglas: the former of these is found not far from Rockhampton, often with stems 6 feet high. Some fine plants of this were sent to decorate the Queensland Court at the International Exhibition held here in 1879, under the name of *M. Miquelii*, but without fruit. The following year similar sized plants were sent from the same locality to the Melbourne International Exhibition, where they produced fruit, which I procured and gave to Baron von Mueller, who soon after published a description of this plant; and I am glad to add that the plants of this sent to the Sydney Exhibition are now growing in the Botanic Gardens here, and both have good-sized stems. This genus does not occur at all in Victoria, and only one species, *M. Macdonnelli*, F.M., is known as yet in South Australia.

I shall now refer to the species of this genus which inhabit New South Wales, and these are: *M. spiralis*, R. Br., *Denisonii*, Moore and Mueller; *corallipes*, Hook; *Paulo-Gulielmi*, F.M.; *tridentata*, Lehm.; *cylindrica*, C.M.; *Fawcettii*, C.M.; *flexuosa*, C.M.; *secunda*, C.M.; and *heteromera*, C.M. Of these only the five first named have been accurately described; all the others will be described by me in this paper. The first-named has

a geographical coast range of nearly 300 miles, extending from Port Macquarie to very near the borders of Victoria, but so far as known it is not found inland, *i.e.*, beyond the coast range. It is a gregarious plant: wherever found, it is in great abundance and massed together. In many places, as in some parts of the Shoalhaven district, and further south, as at Bodalla, it almost exclusively occupies large areas, and indicates a poor, stiff, ironstone-clay soil. In some of its southern habitats it is found with perfectly cylindrical stems, at least 6 or 7 feet high, and from 2 to 2½ feet in diameter, but about Sydney and northwards the stem is cone-shaped, and rarely rises above the ground more than from 6 to 18 inches. Burrawang is the name by which it is known to colonists. The upper part of the stem is densely covered with a fine, soft wool, which has been used in some districts for stuffing beds; and a good starch has been obtained from the seeds, which also, when washed, or sliced and steeped for some days in running water or roasted, were largely used by the aborigines for food. Without some precaution of this kind they are in a fresh state dangerously acrid. It is the larger form of this plant that is no doubt referred to in Brown's *Prodromus* as a possible second species. As has already been observed, the specific designation *spiralis* is an unfortunate one, as, although there is a spiral tendency in its abnormal state, yet usually the leaves are quite flat, and when compared in this respect with some of the species to be presently referred to, it is simply absurd, and tends to mislead. In the year 1855 a second species, that named *Denisonii*, became known, it having been sent to me from the Manning River district by a Dr. Stephenson, then in practice there, who described it as producing stems some feet high.

In 1861 I found this plant in many places on the higher grounds bordering on the Richmond River where, not far from the village of Lismore, some of them attained the height of 20 feet or more. This species is known to range over a considerable extent of country, as it has been found in many places in Queensland, and as far north as Rockingham Bay. It is described as *Lepidozamia Perowskiana*, by Von Regel; in Miquel's *Cycadaceæ* of New Holland, as *Macrozamia Perowskiana*, and by Baron von Mueller as *Eucephalartos Denisonii*, in Journal of Pharmaceutical Society of Victoria; but the name *Macrozamia Denisonii* given to it by Mueller and myself in 1856 I think should stand, as it had priority, and its specific designation, *Denisonii*, given in compliment to the late Sir William Denison, Governor of New South Wales, will always afford some indication of the period of its discovery. In a journey made by me in the year 1858 I collected leaf specimens only of what I then considered to be three new species of this genus, but no fruit of any of these could be obtained at that time, and no proper description could therefore

be given of them; but last year one of my assistants (Mr. Betche) was fortunate enough to collect good specimens of leaves and fruit of two of these, which I have now described as *M. flexuosa* and *M. heteromera*, the last a very variable species, as three very distinct forms of it have been found. The first of these grows plentifully on both high and low situations near Limeburner's Creek, between Raymond Terrace and Stroud, and elsewhere on the Upper Hunter; while the second, in one form or another, is found in various places over a vast tract of country in the south-western district; the third species, to which the name of *secunda* has been given, first observed by me at Reedy Creek, not far from Mudgee, has lately been found by the Rev. J. Milne Curran, Roman Catholic clergyman, in several places near the town of Dubbo, who, at a good deal of trouble and expense to himself, forwarded to me some excellent specimens of this plant, from which I have been enabled to describe it. There can be very little doubt but that this, the most western species yet discovered, ranges still further inland, and may possibly reach to the interior of the continent. The only other species to which I have to refer is that described in Baron von Mueller's Fragmenta, Part XVIII, vol. iii, p. 38, as *M. Miquelii*, and in the Census of Australian Plants, recently published by the same learned author, as *M. tridentata*. I am glad that the specific name *Miquelii* has been abandoned for this plant, as from recollection of it there can be very little doubt that it is quite a different plant from that described from Queensland specimens as *M. Miquelii* in the *Flora Australiensis*. Although I was the first to discover *M. tridentata* in 1861, and sent specimens of it to the Baron, I regret to state that those placed at that time in my herbarium have been utterly destroyed by damp and insects. I am unable, therefore, by comparison to verify the description given of it in the Fragmenta, which, however, can be relied on.

The following description of the different species have either been drawn from or compared with living plants :—

Macrozamia, Miq., species with leaves usually not twisted or contorted.

Pinnæ flat..	1. *spiralis*
,, ,, ...	2. *Denisonii*
,, ,, ...	3. *cylindrica*
Pinnæ nearly vertical..........................	4. *secunda*

Species with leaves usually twisted or contorted.

Pinnæ simple	5. *corallipes*
,, ,, ...	6. *Fawcettii*
,, ,, ...	7. *flexuosa*
,, ,, ...	8. *Paulo-Gulielmi*
,, ,, ...	9. *tridentata*
Pinnæ forked	10. *heteromera*.

1. *Macrozamia spiralis*, Miq.—Subterranean trunk large, broadly cone-shaped, rising frequently above the ground into a cylindrical stem from a foot to 6 feet high and 12 to 20 inches in diameter. Leaves glabrous, 2 to 4 feet long; the rhachis usually more or less raised longitudinally on the upper surface between the two rows of pinnæ. Pinnæ numerous, flat, straight or slightly falcate, the larger ones 8 to 10 inches long and 3 to 5 lines broad, marked on the underside with longitudinal parallel veins, slightly contracted and callous at the base, inserted longitudinally and the lower margin slightly decurrent; the lower pinnæ much smaller, more distant and sometimes passing into a few small teeth. Male cones 7 to 14 inches long, 2 to 3½ inches thick, the scales much flattened, about ¾ of an inch broad, tapering into an incurved point very short on the lower scales, ¾ to 1½ inch long on the upper ones. Fruiting cones varying much in size as the males, from 8 to nearly 15 inches long and 5 to 7 inches thick, the apex of the larger scales 1 to 1½ inch broad, with an incurved point short at the base and ¾ to 1½ inch long at the top.

Habitat.—Not found beyond the coast ranges; extending from Port Stephens in the north to nearly the southern extremity of the Colony. Very abundant near Sydney, where it seldom produces stems. In the Shoalhaven district it is not rare to find it with stems varying from 4 to 6 feet high; in this locality, and in many other places further south, it almost exclusively occupies considerable tracts of country. Native name Burrawang.

2. *Macrozamia Denisonii*, Moore and Mueller.—Trunk 18 to 20 feet high, and at least 18 inches thick. Leaves, 7 to 10 feet long; the petioles angular, glabrous or pubescent at the base. Pinnæ 8 to 15 inches long in the larger leaves, ½ inch broad below the middle, very obscurely and finely marked with parallel veins, only slightly contracted at the base and inserted longitudinally along the centre of the upper surface of the rhachis, without any or only a very narrow line separating the two rows, the upper ones gradually shorter. Male cones 10 to 15 inches long, 4 to 6 inches diameter, the apex of the scales 1 to 1½ inch broad, very thick and produced into a short triangular or lanceolate almost obtuse point. Female cones 1½ to 2 feet long, conical, 1 foot in diameter at the base, 6 inches at the top, the scales shorter and broader than in the males, the apex tomentose-pubescent, often 2 inches broad, tapering into a short and very obtuse or rather longer and lanceolate recurved point. Seeds very oblique, about 2 inches long and 1 inch broad.

Habitat.—In various places from the Manning River district, its southern limit, into Queensland. Near Lismore, on the Richmond, it is found with stems quite 20 or more feet high; it is also very large on the upper part of the Tweed. First discovered by Dr. Stephenson, on the Manning, in 1855.

3. *Macrozamia cylindrica*, C. Moore.—Trunk not raised above the ground. Leaves glabrous, 3 to 4 feet long, slender, of a pale green colour, of a rather upright flaccid habit; the rhachis nearly flat below, and raised longitudinally on the upper surface between the two rows of pinnæ. Pinnæ very numerous, straight, glossy green above, paler and finely striate beneath, the larger ones 1 foot long and scarcely above 3 lines broad, tapering gradually to a sharp pungent point, lower pinnæ much smaller and generally passing into a few small pungent teeth. Base of the pinnæ slightly contracted, of a pale yellow colour—very callous, inserted marginal on the rhachis. Male cones, 7 to nearly 10 inches long, 1½ to 1¾ inch thick, of a strictly cylindrical shape. Scales thick, rhomboidal-truncate,

about ½ inch broad, tapering gradually in a very fine incurved point, scarcely exceeding 3 lines on the upper scales, very short or quite obsolete on the lower ones. Female cones not seen.

Habitat.—In low, flat ground between the Upper Richmond and Clarence Rivers districts, where it was discovered in 1861. This is one of the most elegant of the species, and may be readily known in a living state from all other species by its slender and graceful habit and the bright pale yellow colour of the base of the pinnæ. No fruiting cones have as yet been seen, but all the many plants of this in cultivation in the Sydney Botanic Garden produce male cones in abundance.

4. *Macrozamia secunda*, C. Moore.—Trunk not raised above the ground, ovoid in shape and slightly woolly, covered with old imbricate scales. Leaves usually quite glabrous, sometimes glaucous, from 2 to 3 feet long, sharply recurved near the point. Rhachis quite flat on the upper side and rounded below. Pinnæ numerous, very close together, rising from the rhachis in a rather erect or vertical form, about 6 inches long and not more than 3 lines broad; very distinctly marked on the under surface with from 8 to 9 parallel striæ, tapering sharply to a pungent point, nearly all of the same length till towards the point where they gradually become shorter; of a dull reddish colour at the base. Fruiting cones about 6 inches long and 3½ inches in breadth, scales with very sharp points at the base, very gradually increasing in length upwards.

Habitat.—Near Reedy Creek, east of Mudgee, where it was first found in 1858, but without fruit. Again found with only one old fruiting cone not far from Dubbo, by Rev. J. Milne Curran, in 1883, who sent living plants to the Sydney Garden. This species both in habit and character more nearly approaches *M. corallipes* than any other, but its more spreading habit, the vertical character of the pinnæ, and the non-contorted recurved pointed falcate leaves at once distinguish it from all others.

5. *Macrozamia corallipes*, Hook.—Trunk not raised above the ground, about 8 inches in diameter, subspherical. Leaves 12 to 18 inches long, somewhat rigid, forming a rather contracted crown. Pinnæ 4 to 5 inches long, ¼-inch broad, linear-lanceolate, acute but hardly pungent, dark green above, pale below, and 8 to 10-nerved beneath, inserted obliquely in the rhachis with a bright red, rather swollen petiolule. Male cone glaucous green, 5 to 6 inches long, by nearly 2 inches broad. Scales tapering into an incurved spiny point, which is generally short and rounded on the lower scales, increasing gradually in length towards the top, or in some instances quite obsolete. Female cone glaucous green, 4 to 6 inches long, by 3 to 4 inches broad. Points short on the lower scales, longer towards the top, and very variable in length, as on the male cones, sometimes wholly absent.

Habitat.—First discovered between the General Cemetery and the Liverpool Road, near Sydney; plentiful north of Penrith on the Hawkesbury, and also on dry ridges between Glenbrook and Blaxland, or Wascoe's, on the Western Road. A low-growing plant, seldom more than 2 feet high, often very rigid in habit and usually with leaves very much contorted.

6. *Macrozamia Fawcetti*, C. Moore.—Trunk and base of the petioles covered with a dense tomentum. Leaves varying from 2 to 4 feet in length, of a dark glossy green colour above, paler beneath. Glabrous in an adult state, hairy when young. Pinnæ about three-quarters of an inch in breadth and from 6 to 7 inches in length, semifalcate, broader upwards, and terminating with an abrupt falcate point, which is slightly but sharply toothed. Lower part of the rhachis flat on the upper surface, rather keel-shaped below, gradually rounding in form

upwards till it becomes almost terete towards the apex. Male cones on rather long peduncles, woolly at the base, above 8 inches long and 2½ inches broad; scales flat, terminating abruptly with sharp points. Fruiting cones not seen.

Habitat.—On high ground on the upper part of the Richmond; discovered by C. Fawcett, Esq., P.M. Very little is known of the habit of this species. Only freshly-gathered leaves and old male cones have as yet been seen, but this proves that it is very different from any species hitherto described.

7. *Macrozamia flexuosa*, C. Moore.—Trunk never raised above the ground; about 8 inches in length and 5 inches in breadth, closely imbricated at the base by the old petioles, and slightly woolly. Leaves usually spirally twisted, of a flexuous habit, about 2 feet long. Pinnæ linear, tapering into an acute point, flexible, 6 to 8 inches long, and one quarter of an inch in breadth. Rhachis glabrous, raised on the upper surface between the rows of pinnæ, smooth and round below. Fruiting cones about 6 inches long, 3 inches in breadth, ovate in shape, on short, smooth peduncles. Scales broadly rhomboidal, with points short at the base, which increase in size upwards, and are nearly an inch in length towards the top. Male cones from 6 to 7 inches long, and about 2 inches in breadth. Scales quite pointless at the base, but with rather long and sharp points towards the apex.

This plant, which grows plentifully between Raymond Terrace and Stroud, is in character and habit of growth very different from any other species known to me, and is, in my opinion, entitled to be considered as a distinct species.

8. *Macrozamia Paulo-Gulielmi*, F. v. M.—Trunk scarcely raised from the ground, covered with the woolly imbricate base of the old petioles. Leaves glabrous, 1 to 3 feet long, the rhachis narrow but often flat on the top. Pinnæ numerous, very narrow and often almost terete, contracted and sometimes callous at the base, the longer ones 6 to 8 inches long and 1 to 1½ line broad, thick and obscurely veined. Cones on woolly peduncles of 1 to 3 inches, the males oblong-cylindrical, scarcely above 3 inches long, the scales about 4 lines broad, somewhat thickened at the apex, with a short point. Fruiting cones about 4 inches long and fully 2 inches thick, the larger scales about 1 inch broad and rather thick, those of the lower part of the cone narrower and thicker, the apex almost rhomboidal, with a very short point.

The only habitat given for this plant in New South Wales is a place in New England, where it was collected, according to the *Flora Australiensis*, by a Mr. C. Stuart. Plentiful in many places in Queensland.

9. *Macrozamia tridentata*, Lehm.—Base of the petiole covered with a woolly tomentum. Leaves upwards spirally twisted, sometimes slightly hairy. Pinnæ numerous, inserted marginal on the rhachis, three-quarters of a foot to 1½ ft. long, reduced at the base to spiny teeth, upper pinnæ with 2 or 3 short and sharp teeth at the apex. Male cones 6 to 10 inches long, 1 inch to 1¾ of an inch broad. Scales rhomboidal-cuniat, with spiny points about half an inch long.

Habitat.—Found near the mouth of the Richmond River in 1861. The specimens, then collected and placed in the herbarium of the Sydney Botanic Gardens, have since been destroyed by damp and insects; but the description given of this species by Baron von Müeller, in vol. iii, p. 38, of his Fragmenta, under the name of *M. Miquelii*, may be relied on.

10. *Macrozamia heteromera*, C. Moore.—Trunk small, from 6 to 8 inches long, and about half as broad, covered with a reddish-coloured wool, never rising above the ground. Leaves seldom more than 2 feet long, of an erect habit, never spreading; often, but not always, spirally twisted, sometimes glaucous, but usually of a light green colour; glabrous, or with a few tufts of hairs at the base of the pinnæ. In a young state, sparingly covered with rather long hairs, which disappear towards maturity. Pinnæ simple or variously forked, variable in length, usually about 6 inches long and ¼ of an inch in breadth, gradually tapering towards the base and to a sharp point at the top; when divided the segments become very narrow. Rhachis smooth on the upper surface, rounded below, bearing the pinnæ rather far apart at the base, but becoming closer upwards. Male cones, on an average, 10 inches in length and 2½ inches in breadth. Scales tapering into a short acute point. Fruiting cones when bearing seed, above 7 inches in length and at least 4½ inches in breadth, smaller when in an infertilized state. Scales broad, tapering into a short point, much depressed as in the male cones below the point. Peduncles short, covered with a fine wool at the base.

Habitat.—Among the Warrenbungle ranges and on the Castlereagh River country. Discovered in 1858; since collected near Rocky Glen, between Coonabarabran and Gunnedah. Very variable in habit and appearance, but always with the same characteristics as furnished in this description.

α. *Macrozamia heteromera, var. glauca.*—Very different from the typical form. Leaves longer, less rigid, always glaucous and quite glabrous, bearing a few simple pinnæ at the base of the rhachis, all the others are at least once forked, seldom more. Upper side of the rhachis towards the base marked by a slightly raised edge midway between the rows of pinnæ. Fruiting cones about 9 inches in length and 5½ inches in breadth.

This remarkable variety has only been collected near Narrabri, where it was found by Mr. Betche sparingly on sandy ridges; it is said, however, to be abundant in the Nandewar ranges, about 20 miles distant.

β. *Macrozamia heteromera, var. tenuifolia.*—More rigid and of a neater habit than either of the preceding forms. Leaves usually glabrous, and of a dark green colour. Pinnæ narrow, usually twice forked, and bright red at the base.

Habitat.—In mountainous districts near Tamworth; collected by Mr. Betche.

New Double Stars.

By H. C. RUSSELL, B.A., F.R.A.S., Government Astronomer.

[*Read before the Royal Society of N.S.W., 5 September, 1883.*]

THE following list of 130 new double stars, recently found, is intended as supplementary to my previous paper upon double stars. The measurements have been made by the same observers and instruments and under similar conditions to those described in the previous paper, and it seems unnecessary to repeat what was then said. Many of these are of great interest and beauty, but the majority are small stars. They have been found, some with the large instrument used by myself, others by Mr. Hargrave, using the 7¼-inch equatorial. The star No. 163 in my previous list has been examined, and the R. A found to be 11h. 14m.

List of New Double Stars.

No.	Name.	R.A.	Decl. S.	Position. Measured	Position. Estimated	Distance. Measured	Distance. Estimated	Date of Observation.	Found.	Mag.	Colours.	Remarks.
		h. m.	° ′	° ′	°	″	″		d. m. y.			
1	......	4 26	65 52	236·483	....	26·37	....	1883·101	7 2 83	10 11	......	
2	......	5 3	74 27	167·317	....	0·75	....	83·123	15 2 83	9 9	......	
3	......	6 36	74 53	74·383	....	11·66	....	82·219	22 3 82	11 11	......	
4	......	6 36	43 0	168·567	....	8·28	....	83·200	15 3 83	10 11	......	
5	......	6 42	43 23	332·750	....	13·08	....	82·201	16 3 83	10 11	......	
6	......	6 54	37 19	....	{ 100 200	....	6 25 }	83·194	13 3 83	{ 10 11 10 12 }	......	
7	......	6 55	37 22	80·967	....	7·11	....	83·194	13 3 83	10 11	......	
8	......	7 1	55 34	26·167	....	4·81	....	83·194	13 3 83	11 11	......	
9	......	7 8	56 20	....	170	....	1½	83·241	30 3 83	9 10	......	Preceded by a wide (50″) double.
10	H 3945 ..	7 10	70 18	....	300	....	20	83·208	18 3 83	5 7	......	Small star, suspected double.
11	......	7 26	66 32	83·650	....	19·96	....	82·219	22 3 82	9 10	......	
12	......	8 0	61 14	....	40	....	5	83·285	15 4 83	9½ 11	......	
13	......	8 13	61 20	....	45	....	6	83·285	15 4 83	10 11	......	Diagram.
14	......	8 17	61 10	....	270	....	10	83·285	15 4 83	10 11	......	Diagram.
15	......	8 22	58 42	29·100	....	7·29	....	82·331	2 5 82	10 10	......	
16	......	8 28	60 10	....	355	....	2	83·249	2 4 83	10 11	......	Corner of a large triangle.
17	......	8 35	63 15	....	30	....	3	83·285	15 4 83	11 11	......	Followed by a 9m. star.
18	......	8 41	61 37	350·583	....	10·88	....	83·334	15 4 83	10 10	......	
19	......	8 46	64 55	149·433	....	3·23	....	82·309	11 4 83	8 12	......	
20	......	8 48	58 2	272·083	....	1·67	....	83·334	2 4 83	9 10	......	
21	......	8 50	62 45	49·717	....	7·93	....	83·413	15 4 83	11 11	......	
22	......	9 10	57 23	....	30	....	25	82·290	17 4 82	9 9	......	
23	......	9 12	58 6	....	200	....	15	82·293	18 4 82	12 12	......	
24	......	9 12	58 6	....	70	....	8	82·293	18 4 82	10 12	......	
25	......	9 12	58 6	....	350	....	15	82·293	18 4 82	11 12	......	
26	......	9 13	57 51	278·417	....	8·19	....	82·309	24 4 82	10 11	......	
27	......	9 20	33 10	....	240	....	....	82·348	8 5 82	11 13	......	A faint pair following H 4194.
28	......	9 41	58 49	....	280	....	2	82·356	11 5 82	9 12	......	
29	......	9 43	59 11	....	280	....	10	82·356	11 5 82	10 11	......	
30	......	9 43	59 11	....	35	....	14	82·356	11 5 82	10 10	......	
31	......	9 43	59 11	....	340	....	12	82·356	11 5 82	10 10	......	
32	......	9 44	40 55	182·783	....	18·92	....	82·348	8 5 82	10 11	......	

List of New Double Stars—*continued.*

No.	Name.	R.A.	Decl. S.	Position. Measured	Position. Estimated	Distance. Measured	Distance. Estimated	Date of Observation.	Found.	Mag.	Colours.	Remarks.
		h. m.	° ′	° ′	°	″	″		d. m. y.			
33	......	9 45	59 8	....	40	....	20	1882·356	11 5 82	9 10	......	
34	......	9 47	62 30	117·067	....	4·23	....	83·408	13 4 83	9 12	......	
35	......	9 47	58 37	....	100	....	6	82·356	11 5 82	11 12	......	
36	......	9 47	58 37	....	50	....	6	82·356	11 5 82	11 11	......	
37	......	9 47	58 37	....	160	....	6	82·356	11 5 82	9 10	......	
38												
39												
40												
41												
42	......	9 59	58 15	....	....	....	....	82·356	11 5 82	......	......	9 pairs in a cluster.
43												
44												
45												
46												
47	......	10 1	61 25	351·150	....	0·63	....	83·372	7 4 83	8 10	......	
48	......	10 8	63 45	....	40	....	3	83·208	16 3 83	11 11	......	
49	......	10 9	63 15	....	250	....	6	83·279	13 4 83	10 12	......	
50	......	10 10	60 51	163·717	....	10·14	....	82·367	15 5 82	9½ 10	......	
51	......	10 29	41 7	15·233	....	5·57	....	82·370	16 5 82	11 11	......	
52	......	10 42	61 5	193·100	....	16·43	....	83·372	13 4 83	9 10	......	
53	......	10 48	58 10	216·767	....	4·06	....	83·372	5 3 83	9 11	......	
54	......	10 50	72 10	282·267	....	1·52	....	83·408	7 4 83	10 10	......	
55	......	11 1	60 20	162·517	....	5·48	....	83·408	13 4 83	10 10	......	
56	......	11 14	59 7	150·200	....	4·94	....	83·427	17 3 83	9 11	Yellow ..	Middle star of three in line; another double distance 6″ precedes 2¼′.
57	......	11 18	59 0	255·450	....	6·48	....	83·408	13 4 83	10 10½	......	
58	......	11 18	60 45	....	170	....	3	83·205	17 3 83	12 12	......	
59	......	11 19	58 43	55·983	....	3·58	....	83·422	13 4 83	9 11	......	Diagram.
60	......	11 19	60 58	7·683	....	6·85	....	83·422	4 3 83	11 11	......	In the field with H 4,433.
61	......	11 20	59 12	....	265	....	10	83·279	13 4 83	11 11 11	......	
62	......	11 22	60 50	145·750	....	5·98	....	83·427	5 3 83	10 11	......	
63	......	11 23	60 45	....	95	....	5	......	4 3 83	10 11	......	
64	......	11 23	60 50	....	170	....	4	......	17 3 83	10 11	......	

List of New Double Stars—*continued.*

No.	Name.	R.A.	Decl.S.	Position. Measured	Position. Estimated	Distance. Measured	Distance. Estimated	Date of Observation.	Found.	Mag.	Colours.	Remarks.
		h. m.	° ′	° ′	°	″	″		d. m. y.			
65	......	11 23	62 55	260·650	....	5·24	....	1883·433	25 5 82	10 10	......	Measured 25/5/82; 261·467° pos., 4·73″ Dist., 11 11 Magnitudes. Diagram.
66	......	11 27	59 27	....	330	....	7	83·293	18 4 83	9½ 11	......	
67	......	11 31	59 38	76·967	....	9·69	....	83·433	13 4 83	9½ 11	......	Diagram.
68	......	11 31	59 38	....	310	....	12	83·279	13 4 83	9½ 11	......	Diagram.
69	......	11 38	60 14	4·250	....	1·67	....	83·433	18 4 83	9½ 10	......	Wide double follows at about 90s.
70	......	11 40	46 34	154·017	....	3·51	....	82·386	22 5 82	9 10	......	Large star, yellow.
71	......	11 47	64 0	230·550	....	3·58	....	83·444	7 4 83	8 8½	......	Another pair follows in the same field.
72	......	11 47	64 0	....	170	....	8	83·263	7 4 83	10 11	......	
73	......	11 50	63 14	240·133	....	10·60	....	83·444	7 4 83	10 11	......	
74	......	12 3	63 11	165·350	....	1·54	....	83·446	5 8 83	8 10	......	Same declination as α Crucis; both in the finder's field together.
75	......	12 6	44 6	180·433	....	12·94	....	79·424	5 6 79	9 10	......	Near H 4507.
76	......	12 10	62 28	....	140	....	8	83·173	5 3 83	11 11	......	8 mag. star S.; several other pairs near.
77	......	12 42	64 52	7·983	....	7·71	....	83·446	12 3 83	8½ 10	......	
78	......	12 42	64 37	....	20	....	4	83·192	12 3 83	11 11	......	
79	......	12 42	64 42	165·683	....	8·82	....	83·465	12 3 83	10 11	......	
80	......	12 45	58 23	164·433	....	3·78	....	83·465	4 3 83	11 11	......	Several doubles near.
81	......	12 57	46 56	97·900	....	4·13	....	83·591	5 8 83	8 9	......	
82	......	13 3	63 18	120·783	....	3·12	....	83·465	16 3 83	11 11	......	
83	......	13 6	63 0	34·883	....	1·43	....	83·485	16 3 83	8 11	......	
84	......	13 13	61 30	249·933	....	10·82	....	83·482	16 3 83	10 10	......	
85	......	13 16	61 5	223·917	....	7·56	....	83·483	4 3 83	10 12	......	Diagram.
86	......	13 25	61 42	242·150	....	1·71	....	83·485	12 3 83	10 10	......	Diagram.
87	......	13 26	61 42	338·867	....	3·72	....	83·483	12 3 83	11 11	......	
88	......	13 29	63 42	....	....	....	8	83·203	16 3 83	11 11	......	}
89	......	13 29	63 42	34·150	....	14·95	....	83·483	16 3 83	11 11	......	} Three very faint pairs.
90	......	13 29	63 42	....	....	....	12	83·203	16 3 83	11 11	......	}
91	......	13 39	46 8	....	360	....	6	83·591	5 8 83	11 12	......	
92	......	13 43	57 55	69·983	....	17·27	....	83·509	16 3 83	10 11	......	
93	......	14 21	39 57	....	230	....	12	83·597	7 8 83	10 11	......	
94	......	14 21	39 57	....	350	....	15	83·597	7 8 83	11 12	......	
95	......	14 21	39 0	....	90	....	12	83·597	7 8 83	8 12	......	
96	......	14 23	47 50	....	100	....	10	83·597	7 8 83	11 11	......	

List of New Double Stars—*continued.*

No.	Name.	R.A.	Decl. S.	Position. Measured	Position. Estimated	Distance. Measured	Distance. Estimated	Date of Observation.	Found.	Mag.	Colours.	Remarks.
		h. m.	° ′	° ′	°	″	″		d. m. y.			
97	......	14 23	49 18	....	170	....	20	1883·597	7 8 83	9 10	......	
98	......	14 25	43 24	....	180	....	8	83·597	7 8 83	11 12	......	
99	......	14 25	43 24	....	150	....	12	83·597	7 8 83	11 11	......	
100	......	14 25	40 40	....	260	....	5	83·597	7 8 83	11 11	......	
101	......	14 25	44 18	....	170	....	7	83·597	7 8 83	11 12	......	
102	......	14 30	62 5	85·050	....	4·14	.....	82·542	18 7 82	8 10	......	
103	......	14 41	48 8	....	290	....	4	83·167	3 3 83	11 11	......	In a cluster with an 8 mag. red star.
104	......	14 58	35 46	....	330	....	7	83·641	23 8 83	11 11	......	
105	......	15 2	58 50	23·867	....	13·19	....	83·509	14 4 83	10 10	......	Diagram.
106	......	15 4	59 50	31·867	....	6·95	....	83·548	14 4 83	9½ 11	......	A pentagon of 11½ mag. stars follows. Diagram.
107	......	15 7	55 40	50·400	....	4·76	....	83·548	14 4 83	9½ 10	......	
108	......	15 7	56 25	...	180	....	4	83·282	14 4 83	9½ 12	......	
109	......	15 7	38 50	....	240	....	12	83·643	24 8 83	10 11	......	
110	......	15 8	56 25	....	60	....	....	83·282	14 4 83	10 10½	......	
111	......	15 8	56 50	....	240	....	16	83·282	14 4 83	11 12	......	Diagram.
112	......	15 8	60 44	73·733	....	6·02	....	83·564	14 4 83	10 10½	......	
113	......	15 8	59 57	343·267	....	2·52	....	83·564	14 4 83	10 10½	......	Diagram.
114	......	15 11	39 6	....	340	....	15	83·643	24 8 83	11 11	......	
115	......	15 13	38 56	....	280	....	12	83·641	23 8 83	9 10	......	
116	......	15 14	37 51	....	100	....	6	83·643	24 8 83	8 11	......	Fine star.
117	......	15 15	38 14	....	350	....	4	83·643	24 8 83	11 11	......	
118	......	15 19	36 52	....	260	....	10	83·643	24 8 83	10 11	......	
119	......	15 28	41 48	....	190	....	12	83·657	29 8 83	10 11	......	
120	......	15 30	41 13	....	180	....	9	83·657	29 8 83	11 11	......	
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126	......	17 52	41 45	243·683	....	7·74	....	82·701	14 9 82	10 11	......	
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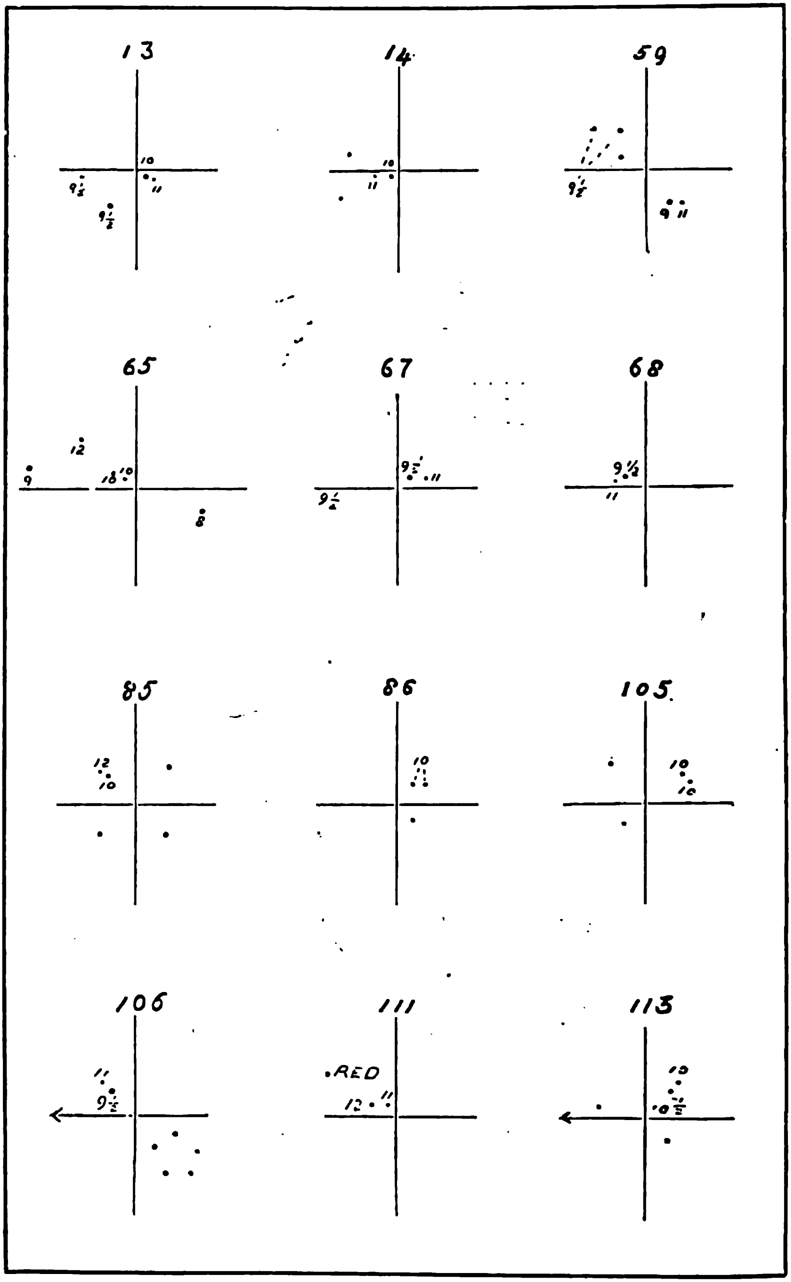
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Some facts bearing upon Irrigation.

By H. C. RUSSELL, B.A., F.R.A.S., Government Astronomer.

[*Read before the Royal Society of N.S.W., 5 September, 1883.*]

So much has recently been said about the irrigation of the interior of this Colony that I am induced to publish now some first results of experiments I have in progress, for the purpose of ascertaining how much water is lost by evaporation from grassed land, and also from cultivated land.

The investigation of this subject is usually left to the agriculturist, and we have no recognized standard instruments with which to proceed. But I take a deep interest in the water that falls as rain, and I am anxious to know what becomes of it. At present I am endeavouring to find how much goes to supply vegetation and evaporation, and my intention to-night is to give you some of the results, so far as they bear upon irrigation; and having, as I said, no recognized instruments, I have designed some which seem to fulfil the following conditions—

(1.) That the grass and soil should each be as nearly as possible in its natural condition, and yet easily weighed as often as may be desired.

(2.) That the parts be as simple as possible, and easily reproduced for use in other places.

Two water-tight square dishes, exactly 2 feet on the side and 8 inches deep, were made of galvanized iron. Each, therefore, has a surface of 4 square feet from which evaporation goes on. Into one of them were put four sods carefully cut from the grass-plot, each being 1 foot square and 7 inches deep; the unavoidable spaces between these were filled up with water and soil. Into the other 7 inches of garden soil were put; each of them was then dropped into a hole in the grass-plot that exactly fitted it, but was only 7 inches deep. The grass and soil in the dishes are therefore level with that outside, and the edges of the dishes stand up 1 inch, to prevent surface water from running in when it rains. The weight is considerable—from 200 to 270 lbs., according to the amount of water present, and it is lifted by means of a lever; a very accurate spring balance comes between the evaporator and the lifting gear. It only takes a few minutes to weigh both accurately to 1-10th of a pound, and 1 lb. is equal to 0·048 of water on the whole surface.

I have but recently begun these experiments, and the wet weather has delayed the work; but, so far as I have gone, the

evaporation from the grass appears to be about $1\frac{1}{2}$ times, and from earth about twice that from water. When the grass is very wet its loss is sometimes $2\frac{1}{2}$ times that from water, and that from the soil has been as much as $3\frac{1}{2}$ times that from water. This is what might have been anticipated, for the grass greatly increases the surface from which the loss goes on; and the soil, from its irregular surface, not only presents a larger surface than water, but is of a darker colour and absorbs more heat. So far it appears that as the surface dries the evaporation become slower, especially from the soil, the grass being different in so far as it, by means of its roots, pumps up the water from below; it however serves another purpose, viz., to deposit dew, and once the amount of water deposited in this way, during twelve hours, 9 p.m. to 9 a.m., was equal to half the amount of evaporation for the previous twelve hours, and I have no doubt that when we get heavy dews the deposit at night will be sometimes equal to the loss by day, *i.e.* in Sydney, where the air is very humid; inland such conditions would not often exist.

In order to see how these observations affect irrigation, let us take Albury as a fair sample of the Murray country, and one from which we have eight years of evaporation results measured from water. Taking the months October, November, December, January, February, and March, the mean of eight years gives each month 4·194 inches of evaporation, and if we take only December and January, the mean is 6·892 in.; and as we have seen, in the previous part of this paper, that in the comparatively humid atmosphere of Sydney the grass lost one and a half times, and the earth twice as much as water, we should have at Albury a loss from grass land of at least 6 inches per month if the soil were kept well supplied with water. If however, the supply of water were limited, and the irrigated surface kept comparatively dry, it is probable the evaporation could be kept down to 4 inches per month during (say) January and February, and about 3 during the other warm months, and 1 or 2 during the remainder, in all about 25 inches would be required to irrigate for a whole year. Generally the rainfall in that flat country would average about 20 inches, and when this is fairly distributed it gives abundant grass, so that it confirms the estimated necessary amount given above. It must however, be borne in mind that when irrigation would be most wanted the heat and dryness of the atmosphere would be greater than under the conditions of a good season, and the evaporation would be also greater, and there can be little doubt that provision must be made for a very free use of water at such times.

When I next take up the subject I hope to have a more extended series of observations on which to base conclusions, but I think it is evident that a very large supply of water would be required; and that the estimate is a fair one is I think evident from the following opinion from perhaps the most competent man in England.

At the meeting of the Mechanical Section of the British Association in 1882, John Fowler, Esq., C.E., F.G.S., the President of the Section, stated in his address "that the cultivated lands of Lower Egypt have an area of 3,000,000 acres, and to irrigate this effectually, at least 30,000,000 tons of water per day would be required, an amount somewhat exceeding the whole of the Lower Nile discharge." This is at the rate of 10 tons of water per day per acre, that is almost exactly a tenth of an inch per day on the surface. The Nile Delta is a flat country, little if any hotter than our interior plains, and situated much nearer to the sea, so that probably the evaporation is not greater there than with us. Now a tenth of an inch per day *at least* is 3 inches per month (at least). Of course here every year brings some rain, and irrigation would not be required continuously, but probably for one or two months during every year. Something like 6 inches over the surface would therefore be required at least, and provision should be made for three times that amount.

Now, as to the quantity of water which the Murray River could supply, some careful observations of the water carried off by the Murray were made by the late P. H. Gell, Esq., for three years, and for three other years I have had daily observations of the height of the river; for its cross section, we have one very carefully made at Ki near Euston, under the direction of the Engineer-in-Chief for Harbours and Rivers. Taking then these quantities, I find the average (six years) outflow of the river, that is, all the water that passes, *floods included*, is equal to 4·8 inches of rain over the river basin. A great part of this is flood-water, which passes away when the country is wet and irrigation not required. Of course some of this could be stored by artificial means, but necessarily in large shallow lagoons where evaporation would be very active, so that the river, even if all the water were taken out of it near its source, for irrigation, which is impossible, would only supply a quantity equal to a general rainfall of 3 inches at the utmost. From this, a considerable reduction would have to be made for loss in distribution; by leakage, &c. I am not opposed to irrigation; on the contrary, I think it is *the* want of the interior of New South Wales, but the one insuperable difficulty that always presents itself to me is to find sufficient water for general irrigation. The rain and river records show a definite quantity; and when I attempt to balance this against the evaporation from the general surface, I always get into the difficulty that I have tried to present to you to-night, and I have brought it forward in the hope that it will be taken up and fairly discussed in what has yet to be said upon the matter. I can understand that there are no engineering difficulties in the way.

On the discolouration of white bricks made from certain clays in the neighbourhood of Sydney.

By Edward H. Rennie, M.A., D. Sc.

[*Read before the Royal Society of N.S.W., 5 September, 1883.*]

(Preliminary communication.)

Considerable annoyance has of late been caused to builders in Sydney by the extraordinary colours which develop in certain bricks, after exposure for some time to the air. The bricks which appear to be particularly liable to this change are those which are moulded under considerable pressure, and afterwards burnt at a comparatively low temperature, in order to prevent the deep colour produced by "hard" burning.

Messrs. Mansfield, being desirous of ascertaining the cause of these appearances, took the matter up, and the investigation came into my hands.

One of the bricks sent by these gentlemen (from the works of Messrs. Monro Goodsell Bros., near Newtown) had been lying in one position for two years. On the side facing the south it was almost entirely covered by a green substance, which, on microscopical examination, proved to be of organic origin, and to consist of one of the *algæ*, probably *protococcus*. On one of the edges of this same brick, however, a yellowish-red patch was observed. On breaking off some of the coloured portion, and putting it into water, a *yellow solution* was obtained in which no trace of organized matter could be detected by microscopical examination. At this time my attention was called to the discolouration of the bricks now being used in various buildings in this city. Some of these were procured, and from them coloured solutions were obtained in which no vegetable cells could be found. One of these bricks was exhibited at a meeting of the Microscopical Section of this Society, and neither at that meeting nor on subsequent careful examination by Dr. Morris could any distinct vegetable structure be found.

This led to a chemical investigation of the yellow or green liquid obtained by simply soaking the coloured portions of the bricks in water. It was found that this solution gave all the reactions of *vanadic acid*.

Since then other bricks from various localities near Sydney have been examined. All show, more or less, the same yellow and green colourations, and these have been proved to be due to vanadic acid.

The presence of vanadium in several clays has been pointed out by Roscoe, and its effect on bricks has been noticed in Germany. Seger has found (Thonindustrie Zeitung, 1877–78) that the golden-yellow and grass green colours which appear in some white bricks from the neighbourhood of Wittemberg are due to vanadic acid. In one case the residue obtained by evaporation of an aqueous solution contained over 44 per cent. of potassium vanadate. Under the article "Vanadium," in Muspratt's *Chemie in Anwendung auf Künste und Gewerbe* (3rd edition), it is stated the production of these coloured compounds depends to a large extent, as might be expected, upon the temperature and nature of the furnace used in burning, and that at a very high temperature an insoluble silicate of vanadium is formed.

Probably the only method of prevention in this case is to use a higher temperature in burning; but then it is no longer possible with ordinary clay to produce such light-coloured bricks.

It will be seen, therefore, that discolourations such as those described above may be due to one or two essentially distinct causes, either

(1) Growth of vegetable matter under favourable conditions, or
(2) Formation of coloured metallic compounds, especially metallic vanadates, in the process of burning.

It may be mentioned here that Forbes (Dingler's Journal, 192, 116) found in a red clay from Shropshire, England, besides vanadium, titanium, cerium, chromium, molybdenum, copper, and even gold. As many of these metals form coloured compounds, it is possible that, in some cases, colours may be produced due to the presence of other substances besides vanadium.

Pressure of work of another kind has prevented me from determining the *quantity* of vanadium in the clay from which these bricks are made, but I hope before long to make analyses of various clays in the neighbourhood of Sydney, with a view of determining this point, and also of inquiring into the presence or absence of molybdic and phosphoric acids. The former has been found in certain clays, and the latter is said to invariably accompany vanadic acid.

On the Roots of the Sugar-cane.

By Hy. Ling Roth.

[*Read before the Royal Society of N.S.W., 3 October, 1883.*]

The knowledge of the growth of cane roots being important to planters, the following experiments were made at Foulden Plantation, Mackay (Queensland) with a view of gaining some information on this point.

A. On 20th November, 1882, a cask 30 inches deep, with the bottom knocked out, and 17 to 22 inches in diameter, was filled with manured garden soil well mixed down to 12 inches from the bottom, and sunk into the ground so that the top of the cask was on a level with the surrounding soil. In the cask were planted, 4 inches deep, two Rose-bamboo plants with three good eyes in each.

B. On the same date were planted a few feet distant from the above, two plants of the same variety of cane, with a like number of eyes and placed at the same depth. This plot trenched 4 feet square and 20 to 22 inches deep. The soil was a light black loam for the first 15 inches, then a heavier brown loam, which at 40 inches depth had merged into river sand. As far as has yet been ascertained, this sand extends down to beyond 6 feet. This plot was not manured.

The cask was raised on 16th August and knocked to pieces, leaving a compact mass of roots binding the earth firmly together. The soil was removed by means of washing with water, but the roots were so fragile that in spite of every precaution many were broken off; in fact, from the quantity of rootlets collected in the water afterwards, I should say that fully one-sixth were dissevered. Plate I will show the dense character of these roots. Some of these roots had spread out laterally, and not being able to extend beyond the cask had gone downwards; other roots, again, had gone down at once. As it was not imagined that any roots would have descended to a greater depth than 30 inches (the depth of the cask) no precautions were taken to prevent the sundering of any roots which penetrated below that depth. I afterwards found that almost all the roots had thrust themselves into the sand below the cask. The cane had been planted very late in the season, but had grown fairly well; the diameter of the canes reached 1½ in., but the colour of the leaves was pale and

unhealthy, having become and remained so after five months growth, owing to the restrictions on the spreading of the roots by the cask. When taken out of the cask there appeared to be more roots than soil, and examined under the microscope, the fine root-hairs (trichomes) showed a diameter of one 250th to one 275th of an inch. Where the roots had come across a lump of manure they had formed a compact net-work.

The roots of *B* were raised on 20th August, 1883. In digging out the roots of this cane, which was grown under perfectly normal conditions, ample room was allowed for the lateral roots, which were found to spread to a distance of over 3½ feet. Having found these, I dug down and gradually approached nearer, until having excavated enough soil at a depth of 5 feet, I began to look for the tips of descending roots. The deepest root thus touched was at a depth of 4¾ feet, being 5 feet 1½ inches long from its departure from the cane plant to its tip in the sand (Plate II, fig. 1). Another root (Plate II, fig. 2*) was 3 feet 10½ inches long, and also grew almost perpendicularly downwards. Starting from above again, the roots on the surface were not quite so dense as those in the cask, but were very close to a depth of nearly 2 feet, below which depth they thinned considerably. The cane, although, like the other, planted late, was fairly grown, with a good healthy colour in the leaves, about 18 inches higher than the cane in the cask, and the canes from 1¾ to 1⅞ inches in diameter. In Plate II the tip of the long root (fig. 1) was broken off in removal; but fig. 2 shows the tip intact; its diameter at the broadest part was 5-16th of an inch. Nos. 3, 5, and 6 are tips of roots found at various depths (No. 6 as deep as No. 2); No. 4 are the surface or upper roots, the same as shown in Plate I. The two root stems Nos. 1 and 2 look very naked; in reality they were not so, but in tracing them back to the planted pieces of cane, all the branches were broken off—their points of disconnection are plainly discernible; the rootlets were exceedingly brittle towards the lower end, and I feared that by attempting too much I might lose all. No roots tipped like Nos. 1 and 5 were found except with a downward tendency, that is to say, I found no lateral roots tipped like those. This, however, does not prove that the cane has two distinct classes of roots, for being very fragile, and being in the loam, which is not so easily disconnected as the sand, I may have missed them in consequence of the tips remaining in the soil.

In the fields, young cane which has sprouted to only 6 to 10 inches above ground will have fine roots going to a depth of 30 inches. All this would seem to indicate that cane like other

* To obtain a thorough idea of the roots, this Plate should be examined through a magnifying glass; the tip of root (fig. 2) would thus be seen to advantage.

plants requires plenty of room for the natural spread of its roots. Where there was plenty of food and the soil was loose enough to allow of the roots to penetrate with ease, there the roots were thickest; where the soil was not in that condition, or there was no great quantity of food, there the roots were thinnest.*

It is much to be regretted that so few writers on the sugar-cane should have given any attention to the roots. In a new work on sugar-growing,† a totally erroneous impression concerning the roots of the cane is conveyed to the mind of the reader. On page 15 a drawing of a cane is given with its so-called root, but the cane, as drawn, only goes so far as to give the point of its attachment to the parent plant-cane, and does not show either the root-stems or the roots. On page 19 another drawing, intended to explain how cane spreads, is also misleading; such a growth is quite abnormal, and might appear once in a man's lifetime. Both these illustrations are taken from "*The Sugar-cane*," written by Porter, and published in 1843. In that work, p. 14, Porter says: "The roots are very slender and almost cylindrical; they are never more than a foot in length; a few short fibres appear at their extremities." These words are copied *verbatim* by the authors of the new work, and how mistaken they are I have shown above.

The only work I have met with where cane is really correctly pictured is a Report by M. Ch. L. Fleischmann.‡ In that Report, fig. 29a presents the underground attachment of a young cane with its rootlets. This drawing is correct so far as it goes, but if more rootlets had been figured a truer idea could be formed.

Discussion.

Prof. Liversidge stated that he saw at Maryborough, in Queensland, roots of the sugar-cane extending down from 8 to 10 feet, where they had been exposed by the cutting away of a bank, and he had been informed by planters that they had traced roots down to a depth of even 12 to 15 feet in light alluvial soil.

* Compare these results with those of Prof. Nobbe, Versuch Station IV, p. 212, quoted by S. W. Johnson.

† "Sugar-growing and Refining," by Lock, Wigner, and Harland, London, 1882.

‡ Annual Report of the Commissioner of Patents for 1848, Washington, 1849. This Report also contains some well-drawn illustrations of microscopic sections of the sugar-cane by M. Corda, Professor at the University of Prague in 1848.

[Three diagrams.]

PLATE No. II.

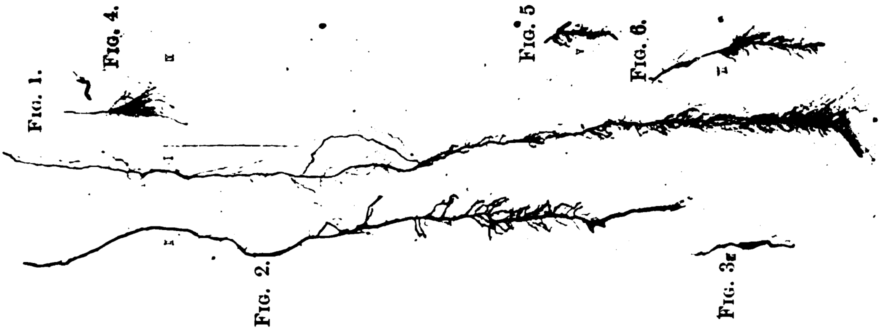

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

Plate No. I.

PLATE No. III.

BLACK TANNA CANE.

Irrigation in Upper India.

By H. G. McKinney, M.E., Assoc. M. Inst. C.E., District Engineer, Harbours and Rivers Dept., and late of the Irrigation Dept., India.

[Read before the Royal Society of N.S.W., 7 November, 1883.]

As the subject of irrigation is admitted to be one of great and growing importance to this Colony, and as it has lately been attracting much notice, the time appears opportune for calling attention to the systems of irrigation adopted in India, where irrigation works are unrivalled in extent and unsurpassed in their management. In an essay such as this it is impossible to give more than a mere outline of such a wide subject. It will be my endeavour, therefore, to convey a fair general idea of the principles on which the works are designed, of the scale on which they are carried out, and of the arrangements adopted in the distribution of the water.

The irrigation systems may be classed under three heads:—1st, irrigation from wells; 2nd, tank or reservoir irrigation; and 3rd, irrigation from canals. The first system has been practised from the earliest times of which there is any record. Under it wells are sunk in such situations as command the levels of the field to be irrigated, and the water when raised to the surface of the ground flows off to the field in channels made for the purpose. The method of raising the water differs in different localities, and according to the depth at which the water is met with. In Lower Bengal and in Oudh, an earthen vessel suspended from the end of a balance-beam is a common arrangement for this purpose. In the North-west Provinces, the cultivators generally use a leather bag, in which the water is raised by means of bullocks walking down a slope. In the Punjab the Persian wheel is almost universally adopted. This contrivance bears some resemblance to a whim of very rude construction, but instead of a winding drum and an alternate lifting arrangement, continuous motion is given to a wheel fixed over the well, and on which is an endless rope, laden with an earthen waterpot on each round, thus supplying a constant stream.

Comparisons have been made of the work done by these primitive methods and their modifications, but such comparisons are of little practical use. The depth at which water is found, the area to be irrigated, and the means of the cultivator, are the first considerations

actually taken into account in settling the arrangement for lifting the water. As a general rule, where the supply has not to be lifted more than 5 feet, baling is resorted to; but beyond this, for small, medium, and great depths, the balance beam, the leather bag, and the Persian wheel respectively are used.

The cost of well irrigation is very difficult to estimate. It is generally arrived at in statistics by reckoning at current rates the time of the men and bullocks employed. As a matter of fact, this does not represent the actual cost to the great proportion of the cultivators, as the labour required is very often present and available in their households. The cost of irrigating by any of the three methods last mentioned is, on an average, about three times greater than the rates charged by Government for irrigation from the canals. Tank or reservoir irrigation is comparatively little practised in the Bengal Presidency, on account of the country being particularly suitable for irrigation from canals. Water from jheels or swamps is, however, utilized for irrigation wherever available, baling being generally resorted to for raising it to such a height as will command the land adjoining. It is sometimes assumed that two men, baling with a palm-leaf basket, will raise 2,500 cubic feet of water to a height of 5 feet in one day; that is, 2,000 gallons will be raised 5 feet for very little over three farthings, at the usual rate of wages for such work in India. I tested the progress made in one case by actual measurement, and found that two men lifted 5,000 cubic feet of water to a height of 8 feet in one day.

It is chiefly with canal irrigation that this paper is intended to deal. Any account of such irrigation would be incomplete without a brief description of the nature of the country, and of the peculiarities of the rivers from which the water is obtained. The immense fertile alluvial plains of Upper India, intersected as they are at intervals by snow-fed rivers, probably afford a grander field for irrigation on scientific principles than any other country in the world. The Bengal Presidency may be considered as two great deltas or doabs, or rather two great series of doabs, the one series extending from west to east along the courses of the Ganges and its tributaries, and the other extending from north to south in the course of the Indus and its tributaries. The courses of the Ganges and Indus and their tributaries, after leaving the hills, are very similar in their general characteristics. The country through which they flow is, to all appearance, a perfectly flat plain, the surface of which is generally from 30 to 60 feet above the level of the river. In every case there is a strip of low-lying land on one or both sides of the river, a large proportion of this land being liable to inundation. The rivers follow very tortuous courses through this low land, or "khadir" as it is termed, and their courses are more or less altered in every monsoon. The variations

in the width of the khadir are frequent and abrupt. For instance, in the case of the Sutlej, in a length of less than 40 miles, the khadir widens out from less than a mile to more than 16 miles.

In 1871, when visiting the scene of the great battle of Sobraon, I witnessed a striking instance of the instability of Indian river beds. The Sutlej at the time of my visit was flowing over a considerable portion of what had been the battle-field, and the village of Sobraon was fully three miles from the river; this intervening space consisting of well-cultivated land. Yet the village of Sobraon stood out on the very edge of the right high bank of the river, and the remains of deserted huts and the partially destroyed cemetery on the bank showed that at no very distant period the village had been in imminent danger of being swept away.

A remarkable point in connection with the rivers is that the surface of the water in them is frequently higher than large tracts of the khadir near them. This fact is due to the tendency possessed by rivers flowing through alluvial land to raise their banks and beds by successive deposits of silt. About the middle of April the melting snows begin to affect the supply in the rivers, and at about 20th June the monsoon sets in; so that the hottest part of the year is the period during which the rivers are highest. Unfortunately there are very few lakes to exercise a moderating effect on the floods, so that the difference between the maximum and minimum discharge of any of the rivers is remarkably great. It is estimated that the flood discharge of the Ganges is equal to that of the Mississippi, while the minimum discharge of the former is a very small fraction of that of the latter.

From this brief description of the rivers, it will be easily understood that the Indian irrigation canals may be divided into two great classes. In the first the canals are carried along the watershed line of the doab, so as to command the levels on both sides as far as possible. In the second class the canals take advantage of the presence of land lying either below the rivers or nearly at their level, and utilize the flood-waters for the irrigation of such land. Works of the second class are known as "inundation canals." The most prominent examples of the first class are the Sone Canals in Lower Bengal, the Upper and Lower Ganges, and Eastern Jumna Canals in the North-west Provinces, and the Sirhind, Bari Doab, and Western Jumna Canals in the Punjab.

It is unnecessary to give a detailed description of any of these canals, but a few remarks regarding their magnitude and the difficulties overcome in their construction will not be out of place. The Upper Ganges Canal, in the difficulties met with and overcome in its construction, in the area of land irrigated, and in the quantity of water it discharges, stands first among the irrigation canals of the world. The head of the canal is beside the sacred

city of Hurdwar, where the river Ganges emerges from the hills. To bring the supply out to the watershed of the doab it was necessary to carry the canal in a westerly direction, and this involved crossing a number of torrents. These torrents, though dry, or nearly so, for the greater part of the year, become formidable rivers in every flood. Of the works required in crossing these rivers the heaviest is the aqueduct in which the canal is carried over the Solani River. This aqueduct is over 900 feet in length, and it affords to the river a clear waterway of 750 feet, in 15 spans of 50 feet each. The clear width of the aqueduct—that is, the waterway allowed to the canal—is 170 feet, in two channels of 85 feet each, separated by a strong retaining wall. The object of this wall was to provide for repairs being done to the aqueduct without stopping the supply. In this case the canal is carried over the river; but in the case of the Ratmoo River, there is a level crossing, while in two other cases the torrents have been carried over the canal, one being allowed a waterway of 200 feet, and the other 300 feet. When the torrents are not in flood, these super-passages are used as bridges.

The Indian canals are on such a large scale that lining them for the protection of their banks would entail an enormous outlay. Both for this reason and on account of the majority of the canals being designed for navigation, every endeavour has been made to regulate the velocity and keep it within moderate limits. The conditions required to suit irrigation and navigation are to a considerable extent antagonistic. A low velocity is favourable to navigation, but involves a low rate of discharge and diminished irrigation. Another disadvantage of a low velocity is that it permits the growth of weeds in the channel. On the Lower Ganges Canal this has lately been a source of great loss and expense. On the other hand, unless the velocity is carefully limited, dangerous and expensive erosion of the banks and bed will occur. Hence, where the natural slope of the country was too great for the canal, it was necessary to have falls or rapids at intervals. In conjunction with these falls, locks had also to be built to provide for the navigation. These works involved heavy expenditure, and the falls required exceptional care and attention, as the engineers who designed and constructed them on the Ganges Canal and on the main line of the Dari Doab Canal had no precedent for such work on such a scale.

With regard to the carrying capacity of the canals mentioned, the Upper Ganges Canal was designed to discharge 6,750 cubic feet per second. This is more than four times the mean discharge of the river Thames, and more than eight times the discharge of the Clyde. In 1868-69, when the rains almost entirely failed throughout the north-west provinces, the discharge during the irrigation of the rabi or cold-season crop was seldom allowed to fall below

6,000 cubic feet per second. The carrying capacity of the other canals mentioned varies from about 1,200 cubic feet per second in the case of the Eastern Jumna Canal to about 5,000 cubic feet per second in the Sirhind Canal.

The principal systems of "inundation canals" are those taken from the Sutlej, the Chenab, and the Indus. They are on a much smaller scale and of a cheaper style of construction than the canals already referred to; and, owing to the frequent changes in the courses of the rivers, they have no permanent heads. As such canals can be utilized only when the rivers are high, they irrigate as a rule only one crop in the year. The system of irrigation from inundation canals is similar to that practised in the case of permanent canals such as those already mentioned. When canal irrigation on an extensive scale had been commenced by the Government of India, the necessity for special legislation became apparent. In order to utilize the water to the fullest extent, strict regulations are required as to the number and duration of the periods during which water will be allowed to individual cultivators. For using the water at any other time the cultivators are liable to penalties, and they are also liable to penalties for in any way altering the discharge of outlets to their fields. The Act which was passed clearly defines the duties and obligations both of the cultivators and the Government officers who have charge of the distribution of the water, and describes the procedure to be adopted in all cases likely to arise. The Act has been published in the vernacular, and can be bought by the people for a merely nominal sum if they wish. As a general rule, the people do not think of troubling themselves about the Act, as they have the utmost confidence in the officers appointed to administer it.

Irrigation is seldom carried on direct from the main canal or its branches. The method adopted is to construct rajbuhas or principal watercourses, which run either along the main watershed of the doab parallel to the canal, or else strike off along the watershed of one of the minor doabs. In the North-west Provinces rajbuhas are divided into two classes, the larger class discharging not more than 200 and not less than 10 cubic feet per second, and the smaller class including channels discharging less than 10 cubic feet per second. The waste of water in irrigation canals is due to the following causes:—(1) Percolation and absorption from the main canal, its branches, and distributaries; (2) waste in conveyance from the distributaries to the fields, and in careless, injudicious, or excessive irrigation; and (3) loss by evaporation in the main canal, its branches and distributaries. The last item is generally the least important. The loss by evaporation from the Ganges Canal and its branches has been shown to be scarcely equal to ten minutes' supply in twenty-four hours. The loss under the first head, that is by percolation and absorption, is considerable; but it is

generally found that after a canal has been running for some time this loss greatly diminishes. The great proportion of loss comes under the second head—that is, in waste after the water leaves the rajbuhas and passes into the hands of the cultivators. For this reason there is no part of the Act more required than that which relates to waste of water. Although it has been shown that much still remains to be done in raising the duty of the supply, still the excellence of the management of the Indian canals is evidenced by the fact that the duty obtained from one cubic foot per second of discharge from them is considerably higher than in the majority of European canals.

On account of the considerations mentioned, long watercourses are prohibited, and this rule necessitates increased length of rajbuha. A cross section at right angles to a canal from one side of the doab to the other will frequently cross four rajbuhas, or in other words, four mile of rajbuha to one mile of canal is not an uncommon proportion. In the case of the recently opened Sirhind Canal, 2,000 miles of distributaries were designed for 502 miles of canal. The Upper Ganges Canal has a higher proportion of distributaries than this. In 1875 it comprised a length of 618 miles of canal and 3,346 miles of rajbuhas, that is about five and a-half miles of rajbuha to one mile of canal, and since then the proportionate length of rajbuha has been increased. The alignment of rajbuhas is a point requiring the utmost care, as it is of the first importance to select the line and adjust the levels so as to command the greatest area of good land. In cases where the water has to be lifted by baling or otherwise, after leaving the rajbuha, only about half the usual rates are charged to the cultivators. Much labour is expended on this style of irrigation; but as might be expected, there is great economy in water. The cultivators having to lift all the water they require, are naturally anxious to avoid either excessive irrigation or loss in or from their watercourses.

Some years ago, when the Lower Ganges Canal was approaching completion, Colonel Brownlow, R.E., then Chief Engineer of the Irrigation Department in the North-west Provinces, and now Inspector-General of Irrigation in India, deputed Captain Ross, R.E., an officer who had taken up the subject of rajbuhas as a speciality, to report on the alignment of distributaries and on the details of irrigation from that canal. When the first portion of the canal was opened, I had the good fortune to be placed in charge of the development of the new irrigation from it. Besides having official instructions for my guidance, I received most useful information from private notes and memoranda of Captain Ross's, which he very kindly permitted me to copy. Briefly stated, the procedure adopted was to make a list of the most suitable places for outlets, and then to ascertain the requirements of cultivators who could

irrigate conveniently from outlets fixed at the places noted. Bearing in mind that the chief waste occurs after the water leaves the rajbuha, the position and nature, as well as the area and level of the land proposed to be irrigated had to be examined before an outlet could be granted. So also the length of the watercourse and the nature of the land through which it would have to pass before reaching the land proposed to be irrigated were points which had to be taken into account. If the inquiry into these particulars revealed any serious objection to the proposed irrigation, the outlet was refused. The outlets are simply earthenware pipes, and are not provided with any special arrangement for measuring the discharge which passes through them, the irrigation being paid for according to the nature of the crop and the area irrigated.

To regulate the use of the water so that as far as practicable there will be a constant supply to meet a constant demand, the system of "tatils" was introduced. Under this system the irrigating and non-irrigating periods are fixed for every rajbuha or portion of a rajbuha, the irrigating periods on some rajbuhas corresponding to the non-irrigating periods on others, so as to utilize a constant supply from the main canal. Where irrigation from a large rajbuha is in a highly developed state, a uniform supply passes into it, so that a complete system of tatils has to be maintained for such a rajbuha by itself. The crops are generally placed under one of two entirely distinct classes—namely, the kharif or hot season, and the rabi or cold season crop. The former, however, comprises two different kinds of crop—namely, (1) the early kharif, consisting chiefly of sugar-cane, indigo, and some kinds of rice; and (2) the late or monsoon kharif, comprising millets, coarse rice, and maize.

The times of sowing vary in different parts of the Presidency; but, generally speaking, the early kharif is sown in March, the late or monsoon kharif in the latter half of June, and the rabi in November and December. The kharif is the crop which requires the greater supply of water, and it is raised at the time of year when the greatest supply is available. Sugar-cane and rice are the crops requiring most water, and indigo and garden vegetables are those which require most care and regularity in irrigating. In seasons of regular rainfall it frequently happens that only one watering from a canal is necessary,—namely, the first flooding of the ground to soften it for ploughing, and make it fit to receive the seed. In such cases only a portion of the usual water rate is charged for the land so flooded.

As already mentioned, the quantity of water required for irrigation varies greatly. The nature of the crop and of the ground, the character of the season, and the style of irrigating, all influence the quantity of water required. In the preparation of canal projects it has been assumed in some cases that for the whole year

one cubic foot per second will irrigate 220 acres; and in others that one cubic foot per second will irrigate 70 acres of early kharif, 50 acres of rice, and 120 acres of rabi. Major Home, R.E., found by actual measurement that, with the tank or reservoir irrigation, as practised in Ajmere, the average quantity of water required for one acre was 177,260 cubic feet, or in other words, one cubic foot per second irrigated 178 acres. Mr. E. C. Palmer also, by actual measurement, found that in the case of irrigation from the Bari Doab Canal, the quantity of water required for the irrigation of an acre of wheat was 42,500 cubic feet, and from his experiments on the quantity of water required to flood the ground as is done in rice cultivation, he concluded that 326,700 c. f. of water would be required for the irrigation of one acre of rice. If we take the irrigating season for wheat as four months, and the same for rice, these figures will give 247 acres of wheat and 32 acres of rice, as the irrigating duty of one cubic foot per second. These figures take no account of the rainfall--that is the quantities of water stated as necessary are those which would be required in the total absence of rain.

It is very difficult for any one not acquainted with India to realize the magnificent services which the canals have rendered in emergencies. In 1868–69, when both the monsoon and the cold season rains almost entirely failed in the North-west Provinces, when the local Government was practically panic-stricken, and when it was generally feared that nothing could prevent enormous loss of life from famine, the Ganges Canal afforded a grand example of what it could do under able management. In that one year the irrigated land increased from 534,000 acres to 1,078,000 acres, and the duty per cubic foot per second rose from 152 acres to 232 acres. So serious was the state of affairs deemed to be that an order was issued, giving authority to the canal officers to sacrifice and pay compensation for crops of sugar-cane and indigo, rather than allow any irrigable grain crops to be lost. On the whole, the services done by the Ganges Canal in that year were such as any nation might be proud of. Had the Ganges Canal been in America, or perhaps even in Victoria, the world would have heard much more than it has about the management displayed. Colonel Brownlow, who was then superintending engineer of that canal, prepared a most valuable and instructive report regarding the canal administration during that year. Considering the extent and value, as well as the nature and success of the services performed by Colonel Brownlow and his staff, it would be difficult to imagine a document more un-American in its character than the report he prepared.

A paper such as this would be incomplete without some remarks regarding the introduction of irrigation into New South Wales and the adjoining Colonies. In the correspondence on the subject which

recently appeared in the *Sydney Morning Herald*, none of the writers seemed to be aware that the consideration of the irrigation question in New South Wales was warmly advocated many years ago by Mr. Bennett, Engineer-in-Chief for Roads and Bridges; and that Mr. Moriarty, Engineer-in-Chief for Harbours and Rivers, also many years ago not only advocated the consideration of the question, but took most important action in the matter. The result of that action is, that at the present time the elaborate surveys, cross sections, and statements of discharges of the Murray, the Murrumbidgee, and the Darling, which Mr. Moriarty had then prepared contain the most valuable information in existence regarding the possibility of carrying out irrigation works on an extensive scale with those rivers as the sources of supply.

The inquiry into the prospects of irrigation in Victoria has been dealt with exhaustively by Mr. George Gordon. Some months ago that gentleman also prepared a valuable report on proposed improvements in the Darling, and when doing so had the benefit of the survey maps of that river which had been made under Mr. Moriarty's direction, and which were on this occasion specially lent under official sanction. As the public does not seem to be well-informed as to what is being done in the matter of irrigation, it may be mentioned that at the present time Mr. Bennett, as Engineer-in-Chief for sewerage works, is preparing land and having works carried out for sewage irrigation.

In connection with the introduction of irrigation into New South Wales, the question of evaporation has received much attention, but it has been dealt with so ably and fully by Mr. Russell, Government Astronomer, that only a passing notice is required. It has already been stated that the loss by evaporation from the Ganges Canal and its branches and distributaries amounts to ten minutes' supply in twenty-four hours on an average. The maximum evaporation registered at Roorkee, with a hot wind blowing continuously, was half an inch in twenty-four hours. From a series of experiments made in Southern India on a reservoir 1,375 acres in extent, Major Mayne, R.E., concluded that the mean evaporation at that place was at the rate of 0·165 of an inch in twenty-four hours, that is, 60 inches per annum.

It has been stated in the recent controversy that irrigation is likely to cover the ground with a deposit of salt, and that this has taken place on a large scale in India. There are extensive tracts of country in the North-west Provinces in which crops grow badly or not at all, and which are more or less covered with a saline efflorescence. The subject of dealing with this "oosur," as the salt is locally termed, occupied much attention some years ago. I was in India at that time, and read all the information I could obtain on the subject, and I do not recollect that a single authority endeavoured to show that the efflorescence was due to deposi-

from canal water. As a matter of fact, the oosur plains were in existence before canals were thought of. So far as I am aware, the only foundation for the idea that oosur is due to canal irrigation is that in the first place canal water passing through oosur land to good land will gradually spread the oosur over the latter, and that in the second place excessive irrigation of land slightly impregnated with oosur will bring the salt to the surface.

Irrigation is paid for in India according to the nature and acreage of the crops irrigated,—not because this is the best system, but because it is believed to be better suited to the country than any other yet proposed. In Australia, I think, it would be better to follow the European system of paying for the quantity of water used. As the water supply in Australia is very limited, no pains should be spared to raise the duty per cubic foot per second to the highest figure obtainable.

Another point which I wish to refer to is the comparatively small quantity of water discharged by the Australian rivers, and the consequent impossibility of obtaining large supplies for irrigation from them. When the Ganges Canal was constructed, the whole available cold season supply was taken from the river; yet at the distance of only a few miles the discharge in the river was found to be very considerable, and further on it increased to such an extent that the supply taken from the canal was found to be little missed. From what I have read and seen of the rivers of this Colony I think it is highly probable that the effect of withdrawing a large supply from some of them would be of less importance comparatively than in the case of the Ganges.

In India irrigation works have ensured large tracts of country against the possibility of famine, and they have brought under permanent cultivation hundreds of thousands of acres, from which few or no crops were formerly obtained. Although irrigation cannot be conducted on such a scale in this Colony, still the field is a wide one. So far as irrigation is concerned, the Chinaman appears to be the only cultivator who has discovered that "Providence helps those who help themselves." In a country where labour is so expensive as it is here, exceptionally favourable circumstances are required to render irrigation profitable; still it seems scarcely credible that such favourable instances have not arisen. The time for extensive irrigation works in this Colony is surely, if slowly, approaching; but before its arrival, if private enterprise fails to carry out works of the same kind on a small scale, I believe it will be from want of enterprise and knowledge, and not from want of opportunity.

Tanks and Wells of New South Wales, Water Supply and Irrigation.

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(Communicated by W. H. WARREN, C.E.)

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THE necessity for a liberal consideration of the question of water supply for the dry districts is of such rapidly increasing importance to those districts and to the Colony generally, that the time has arrived for active steps to be taken to obtain, by actual survey and observation, the data necessary to determine the best means to be adopted to conserve and distribute, in an economical and effective manner, that portion of our rainfall now carried off by our river systems and discharged into the ocean, conferring but little benefit on its course; though running through districts where the soil only requires its invigorating agency to produce in abundance any vegetable growth suited to the climate.

In framing this paper I have divided the subjects to be dealt with into two sections:—

I.—Water supply for stock routes.
II.—Water supply for irrigation.

This course is advisable for two reasons: because the works to be dealt with, that have up to the present time been carried out by the Government, have been solely for the improvement of the stock routes; and because the important works necessary on these routes cannot generally be brought within the scope of any scheme having irrigation as its main object. Isolated cases may occur where watering-places could be provided for in this way, but as a rule it will be found that the supply for this purpose must be obtained from works complete in themselves, and constructed solely with a view to meet the requirements of stock traffic. This is a necessary consequence, inasmuch as stock routes are laid out to afford the best and shortest practicable connection between the terminal points, and without any reference to those differences of level that would prevent their being introduced into a general scheme of water supply. Cases might occur where points on such routes could be supplied from the irrigation channels, but such points might not be suited to the general division of the watering stages along that route.

I.—Water Supply for Stock Routes.

The stock routes of the Colony have an important bearing on pastoral industry, and deserve greater attention and expenditure in opening and improving them than they have hitherto received. Much may have been done, but very much more remains to be done before they can be considered efficient in facilitating the transmission of stock. They are the only avenues from the pastoral districts to the consumer, and from one pastoral district to another. Properly watered and managed they would be invaluable as affording a *certain* outlet to the markets, and also as a means of reducing to some extent the enormous losses that so often overtake the sheep-farmer during dry seasons; for at such times he would have the chance of removing some portion of his stock to more favoured localities for water and feed. It has unfortunately been the case that, even when improved, these routes have not been of as much service as is desirable. This is to be attributed to the long intervals separating many of the works that have been constructed for watering purposes; to the defective maintenance of many of those works; and to the defective conditions regulating grazing on the stock routes. When it has been determined to water any stock route, arrangements should be made to construct all the works necessary to complete the chain of communication, instead of constructing watering-places that, until that chain is complete, can only be rendered available at considerable loss and injury to travelling stock, or when the long intervals separating them are bridged by natural supply, at which time there is but little need for the water that has been artificially conserved. It is unfortunately often the case that many of these routes are practically closed, by want of feed, even when plenty of water is obtainable; and it is a matter of great importance that this evil should be remedied as far as is practically possible, and measures adopted to make the stock routes of sufficient width, to withdraw them from lease, and protect them from being grazed on by other than travelling stock.

In the year 1869, the Government first practically recognized the necessity for constructing watering stations on the stock roads, and a sum of £5,000 was then voted by Parliament for works on the Booligal and Wilcannia Road, and handed over to the Roads Department for expenditure. At that time no works of a similar nature had been carried out by the Government; and this, combined with an imperfect knowledge of the character of the country to be dealt with, led to a course of action being adopted which, however suitable it might have proved under different circumstances, required considerable modification to adapt it to the existing conditions of the question. The primary object was to obtain water by sinking, and with this view a boring plant,

consisting of the ordinary rods and bits, was sent on to the ground, to test the nature and depth of the strata and the quality of the water to be procured.

The preliminary borings were commenced on the 1st October, at the Jumping Sandhill, about 30 miles north of Booligal, and were completed at Mount Monahra, about 120 miles from the same place, in January 1870. The camp was then broken up, as there was no water on the "Death Track" between there and Wilcannia, a distance of 80 miles. To have carried out the works along that line would have necessitated a very heavy expenditure for haulage of water. In addition to this there were other reasons for suspending operations, chief of which were the difficulties experienced in obtaining and keeping efficient men; the high cost of labour, and the comparatively small depth to which the borings had to be carried. This latter cause had a most important bearing on the question, for it was found that the time occupied in shifting a large camp and plant from one site to another, and in making the preparatory arrangements for boring, raised the cost of the work to a great extent; had the drifts that were tested been deeper seated, the borings could have been carried out at a proportionally less cost per foot. The experience gained during the work was wanting at the outset; but, though it can now be seen where mistakes were made and unnecessary expenditure incurred, it must not be forgotten that the Department acted for the best and carried out the work under very considerable difficulties, further, that the experience gained, though perhaps rather costly, has been of much value and an eventual source of economy.

Looking back at those early efforts, there can be little doubt but that the better plan to have adopted would have been to have made a preliminary examination of the district in the first place, ascertaining how far it had been tested by works carried out by the Crown lessees, gaining information as to the depth and character of springs in existing wells, their positions, and the cost and character of works best adapted to the object in view. Sites could then have been determined, and tenders at once invited for sinking wells where there was a reasonable probability of obtaining suitable water. Where existing works proved that wells were not advisable, arrangements could have been made for works to conserve storm waters; and in case of the surface features being unfavourable for tanks, the locality could have been tested for an underground supply by *letting* trial shafts, and possibly boring from the bottom of them for deeper seated springs, if considered necessary. Day labour would have been avoided in every possible way, for all the drawbacks connected with it in the settled districts were very much intensified in that back country. The works would then have been completed much sooner, and, as the

cost of preliminary operations and of supervision would have been considerably reduced, there would have been a larger amount left for opening the road.

When the explorations were concluded, tenders were invited for the works determined on, and the following tanks and wells were at once put in hand, and completed in 1872:—

Well near the Willandra, at Mossgiel.
Well at Ivanhoe.
Tank at Boonoonoo.
Well at Mount Monahra.
Tank at Forty-eight-mile Swamp.

Since these were completed, further sums were voted, which have been expended as shown in the following list:—

Deniliquin to Hay—Pine Ridge—Dam.
" " —The Gums—Tank.
Hay to Booligal—One-tree—Tank.
" " —Quondong—Tank.
Booligal to Wilcannia—Jumping Sandhill—Well.
" " —Holy Box—Well.
" " —Twelve-mile Swamp—Tank.
" " —Thirty-five-mile Swamp—Tank.
Wilcannia to Hungerford—Copargo—Dam.
" " —Peri Sandhill—Tank.
" " —Nipper's Creek—Tank.
" " —Warramurtie—Tank.
" " —Gambolara—Tank.
Balranald to Ivanhoe—Box Creek—Tank.
" " —Youhl Plains—Tank.
" " —Till-Till—Tank.
Cobar to Nyngen—Booroomugga—Tank.
" " —Muriel—Tank.
" " —Hermitage—Tank.
Cobar to Bourke—Cobar (Stock)—Tank.
" " —Cobar (Town)—Tank.
" " —Nullima—Tank.
" " —Tindary—Tank.
" " —Curraweena—Tank.
" " —Corilla—Tank.
" " —Two Water-holes—Tank.
Cobar to Louth—Cutty-gullaroo—Tank.
Bourke to Ford's Bridge— Tank.
Walgett to Bangett—Boro Water-holes—Tank.
" " —Lightning Ridge—Tank.
Barwon to Narran—Cumborah—Tank.
Narrabri to Moree—Galathera—Tank.
" " —Boggy Creek—Tank.
Wagga Wagga to Bland—Junee—Dam.
" " " —Wallace Town—Dam.
Wagga Wagga to Cootamundra—Hurley's—Dam.
Albury to Tocumwall—Major's Water-hole—Dam.

In 1882 a sum of £50,000 was granted for tanks and wells, and arrangements were made for its expenditure on the different stock routes recommended by the Mining Department. This amount was so much in excess of any previous grants which had hitherto

been of a desultory and intermittent character, that it was considered advisable to frame and adopt a more systematic course of action; and with this view, type drawings and specifications were prepared, embodying the results of the experience gained by the officers of the department during the time they were engaged on this duty. This course was considered all the more necessary, as the large increase on previous grants indicated a recognition of the growing importance of the question; a recognition which will probably be followed by a development of present operations, so as to include the more important works connected with a general scheme of water supply for irrigating portions of the rich but arid districts of the Colony. A further sum of £53,800 was voted on this year's estimates, which with the amount granted last year, is being expended on tanks and wells as rapidly as possible; but great difficulties have been experienced in getting contracts for their construction taken up, the seasons having been exceptionally unfavourable for these operations. This has in many cases considerably increased the cost of the work; but it was considered advisable in the more urgent cases to carry out their construction at once, even at an increased outlay, rather than delay it to a more favourable season.

The works by which the stock routes have been supplied, or partially supplied, with water, may be divided into the following classes:—

1. Wells,
2. Tanks,
3. Dams,

and it will be advisable to deal with them in this order, describing the nature of the conditions surrounding each class, and the operations that have been and are now being carried out by the Government, in endeavouring to construct works that, while economical in detail, will at the same time ensure a permanent supply of water both for stock and human consumption.

1. *Wells.*

The conditions under which drift waters are obtained, and their important bearing on the settlement of the dry districts of this Colony, give this branch of the subject as great an interest as any with which we have to deal. This interest is, in a measure, due to the difficulties surrounding a satisfactory solution of the origin of, and the varying conditions under which these waters are discovered; but still more is it due to the fact that this source of supply, when the quality of the water is suitable for stock, is at once the most certain and economical means of meeting the great want which settlers in that country have to contend against. So far our experience of the question may be considered as confined to the more shallow-seated and unfortunately non-artesian drifts;

but it is a matter for congratulation that money has been voted by Parliament, and operations commenced, for testing the great west and north-west country for a deeper seated and hoped for artesian supply; should the predictions regarding the existence of such a supply prove well founded, and the water that may be discovered, prove suitable for stock, or still further, for irrigation purposes, it will be almost impossible to estimate the increased facilities that will be offered to settlement, or to assess the increased value of that portion of our territory.

Whether the predictions are likely to be realized appears to be a question that can only be satisfactorily settled by the *boring rods*. Theorising, though much has been indulged in, has so few well ascertained data on which to build hopes of an ever-flowing, inexhaustible supply, and is opposed by so many ascertained facts proving the uncertainties connected with the discovery of water in the shallower drifts, that we may, if hopeful, wisely be doubtful, till all room for doubt is disposed of by actual test.

Many reasons have been advanced by the advocates of an artesian supply to support their views; amongst others, the mud springs between the Darling and the Paroo, and the height to which water has risen in some of the deeper wells north of the Darling. These are *facts*, but whether they are entitled to the wide interpretation given to them—whether they indicate *general* and not merely *local conditions*—remains to be proved.

The Government Astronomer, in his "Rain and River Observations," for 1880 and 1881, has published some very interesting reports bearing on this question; but it may possibly be found that the deductions he has drawn may be capable of very considerable modification when the conditions connected with the rainfall on the Darling basin are investigated. In his report for 1880 he writes—"Since the rain measures of 1880 and the river measures for the same period are more complete than they have ever been before, it will be worth while to test one by the other. I have before endeavoured to prove that the water passing down the Darling in an average year is only a very small portion of the rainfall, and is in fact very much less than must be available for that purpose after every allowance that can be made for evaporation and vegetation. For 1880 we have the means of testing this question by observations more complete than any which have previously been taken over the best part of the watershed of the Darling, that is the western slopes of the Main Range, where, from the abundance of rivers and creeks, it is obvious that the rain water readily runs off the soil. There are forty-five rain stations, and the mean rainfall derived from these is 20·74 inches; the area included is about 110,000 square miles: all the drainage from this country passes Bourke, in the river Darling, and at this point a daily record of the height of the river is kept, and the mean

result shows that the river has averaged throughout the year 6′ 8″ above the summer level. The width of the river at Bourke is 180 feet, and the velocity when in flood is rather less than one mile per hour. A few figures which I need not give here suffice to prove that ¼ of an inch of rain over the watershed, or $\frac{1}{80}$ part only of the rainfall, represents all the water that passed Bourke during the whole year. When full allowance is made for the power of evaporation in a dry year, and for all other circumstances which might prevent the rain-waters reaching the rivers, it is certain that a very much greater proportion than $\frac{1}{80}$ becomes running water. In such country as that under discussion common experience would give ⅓ of the rainfall as the available water, but for the sake of being on the safe side, we will assume that only $\frac{1}{10}$ of the rainfall becomes running water, and it still represents a quantity sufficient to supply eight rivers like the Darling for the whole year.

"It therefore seems impossible to doubt that an unlimited supply of water passes away underground, more in fact than would suffice to make the whole of the western districts a well-watered country, and all that is wanted to make this supply available is a judicious use of the *boring rod*."

"In his report for 1881 Mr. Russell further states:—"The evidence is conclusive that the annual supply from rain finding its way into this great natural storehouse is perfectly inexhaustible; it is also certain that as much must find its way out as in, every year, under natural conditions, and the few wells that have been sunk prove that the outlet is so situated that the water is under pressure in the reservoir, and will rise up to or above the surface when wells are sunk into it."

Mr. Russell speaks with no uncertain voice, and as his views have an important bearing on the question of water supply for those districts, both as regards wells and surface conservation, they are well worth our serious consideration.

The rainfall over the Darling basin above Bourke having been determined with more or less accuracy during 1879, 80 and 81, and the mean level of the river at Bourke having been also ascertained for the same years, we are enabled to make a rough comparison of the fall and discharge.

1879.—Mean rainfall...	33·24 inches.	Mean river level ...	29·08 feet.
1880. " "	20·47 "	" "	6·66 "
1881. " "	18·88 "	" "	0·75 "

The proportional difference between the rainfall and the river discharge for these years is so great that it necessary to try and discover a reason for the discrepancies, and then, if possible, show the connection this may have with the general question—that the enormous proportion of the rainfall, mentioned by Mr. Russell, disappears underground and feeds our waterbearing drifts.

In 1880 and 1881 it will be seen that the rainfall was very nearly the same, yet in the latter year the discharge, which, if there were no disturbing elements, ought to correspond, was only ⅙ of what it was in 1880. Again, in 1879, the rainfall, which was 80 per cent. in excess of 1881, was accompanied by a discharge thirty-eight times as great. There must be some reasons for these diffirences, and as they have an important bearing on the estimated loss by a deep soakage it will be well to consider how they can be accounted for.

In the first place the mean rainfall must be considered, and by referring to the rain maps there appears to be a possibility that this has been over-estimated. These maps show that there are a greater proportional number of observingstations on the eastern side of the watershed than there are on the levels occupying the central and more westerly sections; and as the rainfall is greater on the eastern side, any preponderance of observing stations there must give an excess on the true mean, unless the area composed by each station is made an element in the calculation.

The discharge of the Darling at Bourke also appears to have been incorrectly estimated and to be less than the actual discharge. The estimate is based on the velocity of the river in its normal state, that is, on the velocity when there are no disturbing influences, as when the river is in flood and full for a considerable distance above and below the point of observation. This velocity is estimated at nearly one mile an hour, and, with the cross section of the river waters at their mean level, forms the basis on which the discharge is calculated. If we examine the river curves at Bourke, we find that the floods are in many cases of short duration, forming a series of waves succeeding one another at longer or shorter intervals. This being the case, the normal velocity can scarcely be considered a satisfactory factor, as it should have an increased value when the river is at its higher levels and the water coming down in a wave. This is borne out by Mr. Russell's statement that a flood in November, 1881, travelled from Bourke to Wilcannia in three days—this gives a velocity of *seven* miles an hour.

The proportion of rainfall likely to become running water must to a great extent be dependent on the features of the watershed. On the eastern side, which is bounded by the coast range, the proportion must be much greater than it is on the levels, where but a very small percentage finds its way into the main channels; and when the rainfall is greatest on the eastern side of the shed, we must expect to find that a larger proportional quantity finds its way into the river, than when contrary conditions prevail. *This was decidedly marked in 1879*, when there was such a great discrepancy between the *supposed* mean rainfall and the river discharge, as compared with the two other years quoted. The

conditions under which the rainfall occurs must also have an important influence; the heaviness of the fall, that is, the quantity measured by the time; the intervals separating different falls; and the state of the ground at the time of the fall, whether dried and cracked by summer suns and capable of absorbing largely; or with a close saturated surface capable of throwing off the maximum proportion of the rainfall. Account must also be taken of the enormous bodies of water brought down by the rivers that are intercepted and diverted in filling lagoons, warrambools, swamps and lakes; and that in heavy floods, are thrown back over the level country for scores of miles, and largely retained there when the floods in the rivers recede; retained in shallow creek beds and swamps, when the evaporation is enormous.

These causes—over-estimated rainfall—under-estimated discharge—*enormous* evaporation on the levels which form the largest proportion of the area of the basin—the loss in filling secondary channels, &c.—and the surface soakage—all taken together, may probably materially modify the results arrived at by Mr. Russell.

It may be advanced that the "surface soakage" just alluded to is the great source of loss, that, percolating to the lower drift beds, is their main supply; but the soakage referred to is of a very different character, and that it takes place to an enormous extent is known to all who are acquainted with the country under consideration. The dry, parched soil, seamed with cracks and fissures, hungrily drinks in the water falling on it, but the impermeable clay beds prevent its descent to any great depth, and the burning summer heats and dry thirsty winds rapidly evaporate the water lying on the surface of the ground, dry the soil, and the moisture carried away from the surface layers is replaced from below by capillary attraction, and exposed to evaporation under conditions which reduce it to vapour much more rapidly than it can take place from a water surface.

That there may be places where large quantities of water find its way underground, to supply the lower drift beds, cannot be positively denied; but that such wholesale percolation takes place generally is very improbable; and if the conditions advanced fail to support the view that this enormous loss by percolation does not take place, then it would be interesting to ask how this large body of water is disposed of; and how far our knowledge of the conditions under which water-bearing drifts are discovered in that country sustains or disproves the assumption that they are so lavishly supplied from the surface.

The geological bearings of the case I leave for those more conversant with that science than I am, but *en passant*, it would be interesting to ask this question. Where is the subterranean outlet for the enormous proportion of the rainfall that has been and is being absorbed on the Darling watershed above Bourke, if Mr.

Russell's assumption is correct? Is not its escape to the ocean barred by the older rocks that crop up through the alluvial deposits, and that extend from the dividing range between the Lachlan and Darling near Gilgunnia, through Cobar, and running northerly with some *surface* breaks, cross the Darling on to the Warrigal? It appears very probable that these older formations must cut off the alluvial deposits to the east of this line from those to the west, and therefore from the ocean, and that consequently the assumed percolation on the Darling basin should be stored locally, and that the increasing storage should show itself in an increasing rise in well waters in that district or in surface springs. But this is not the case. Again, assuming that this rock barrier does *not* exist, and that the drift beds are continuous to the ocean, we are met by as great a difficulty in reconciling such a discharge to the conditions of the case. A thousand miles of drift must oppose an insurmountable obstacle to a free discharge of water; and assuming that it has an existence, there should be a very perceptible rise in the levels of well waters, more particularly towards the eastern side of the shed and during wet seasons; this is however not the case.

Apart from these views, there are several other considerations that have an important bearing on the case, and that are difficult to reconcile with Mr. Russell's views. Those who have conducted boring operations or have sunk shafts in that country, or those who have watched and noted the work carried out by others, must be aware that in the alluvial country it is very rarely that water is missed at the ordinary depths of the shallower seated drifts underlying those districts; they must also be aware that there are thick beds of stiff impermeable clays passed through before water is obtained; that the water when struck rises to a greater or lesser extent, and then retains that level, independent of either long continued dry or wet seasons. The conclusions to be drawn from these works, which at intervals are pretty well scattered over that country, is that the water-bearing drifts and overlying clays are general. This being the case, how can the extensive soakage assumed to exist in accounting for the small discharge of the Darling as compared with the rainfall on its basin, be accepted as reasonable? Again, if instead of admitting general loss by soakage, we admit that it may occur on a large scale in certain localities, we have to face the same difficulty in reconciling a varying head of supply with a constant level in the wells tapping these drifts. If it is said that this uniformity is due to the fixed level of the discharge of the drifts beds it does not relieve us from the difficulty, for whether the level of discharge is regulated by the ocean level or whether that discharge takes place before reaching it, there must be such an enormous length of drift to be travelled by the water before obtaining an outlet that the back

pressure would be virtually equivalent to a seal. Again, if this constant feeding and escape of water is going on now it must have been going on for ages past, and it therefore appears strange that, as it had been found that brackish surface drifts improve by being worked, that all the brackish elements have not long since been washed out of the deeper drifts by the constant assumed flow through them. The objections now raised naturally point to an old supply for these drift beds—a supply which has remained stagnant and locked up for ages—a supply that is exhaustible with time and pumping plant, and which is so inconsistent with the views held by those who have fondly dreamed of a perpetual artesian flow, that it is not at all likely to be kindly received by them. They have, however, the pleasure of knowing that their theories are opposed only by theory, and this shows the necessity that exists for obtaining, by systematic effort, data connected with this question; until this is done, all efforts to arrive at a satisfactory solution of the apparent inconsistencies which are constantly cropping up will be futile. Mr. P. K. Abbott collected many facts relating to wells in the Liverpool Plains district, and, in a very interesting paper read before this Society, in November 1880, gives much valuable information bearing on the question in that locality. The observations commenced by this gentleman should be followed up in other parts of the Colony, the positions of all works of this character being determined and marked on a map; the level of the drift containing the water and the level to which that rises in the bore or shaft being shown in each case, and the levels reduced to a uniform datum. The strength of supply and quality of the water, with the influence of long continued droughts or wet seasons should also be noted. In the course of time, when the level, above alluded to had been determined over a large area of country it might be possible, *if there is any under ground flow*, to plot a curve giving a value to the head of supply, and the back pressure in these drifts. The general information, when a sufficient amount of it has been collected, might enable the courses of the drift channels to be traced, and save much loss of time and capital in uselessly sinking upon salt-water leads.

In the works constructed by the Government for reaching, lifting, storing, and distributing underground waters, the shafts are slabbed right through, and divided into two compartments, each 2 feet 6 inches square, by a brattice extending from the top to the bottom of the shaft. The lifting appliances consist of a whim and gearing working two self-acting buckets, which discharge into a timber-framed, iron-lined service tank communicating with the troughing for watering the stock. In carrying out these works, great care has to be taken to have the slabbing thoroughly fitted, and clay well puddled into all spaces at the back of same. Care

must also be taken in having the shaft carried down truly and having the runners properly fixed, as the smooth working of the buckets is dependent on attention to these points; while all roughness or jarring in their travel very soon loosens the slabbing and increases the cost of maintenance. Some of the water-bearing drifts are very troublesome and difficult to deal with, and in such cases if the water has a considerable rise, with a strong supply, it will often be found advisable not to sink to the drift, but to stop some few feet above it and then put down a carefully tubed bore to tap the water. Boring can also be advantageously resorted to in some cases, to avoid the necessity of puddling back water of bad quality—often a difficult and expensive operation—when it is underlaid by good water having a sufficient rise to give the required supply in a shaft sunk to within a few feet of the former.

When these works were just initiated several modifications of the type adopted were considered by the Department, and amongst these were :—

1. Brick-steining in lieu of slabbing. The objections to this proposal were based chiefly on the increased cost, and on the difficulty, which in some cases amounted to a practical impossibility, of obtaining labour and material for the purpose. A modification of this proposal was also considered, to stein the lower portion of the well in this way to protect the water from the effects of the timber slabbing, but it was not adopted, as a composite system would have been awkward on account of the change in the shape and dimensions of the shaft that would have been necessary. The cost and difficulties before alluded to were also, at the time prohibitory.

2. The employment of masonry and of puddle for service tanks was also considered, but at the time framed timber lined with galvanized iron was adopted as being more certain and better adopted for the purpose than either of the others. Stone is often far more difficult to procure than timber, and lime or cement becomes very expensive on account of the cost of carriage. Masonry service tanks are now being constructed in a few cases where timber is very scarce and stone procurable close to the work. Earthen puddle tanks require great care in their construction and in their maintenance; they should never be allowed to run dry, as if they do they soon begin to lose water; but where they are attached to wells where a constant supply of water is available to keep them full, they would, if attended to, prove more economical than either the framed or masonry tanks; and as their use would allow of a large storage at a small cost, wells having a weak but steady supply could in many cases be utilized. Iron-framed, buckled plate tanks are now being tried, and should prove more lasting and economical than any other type yet adopted.

3. The use of pumps in lieu of the primitive whim was also considered and abandoned, as at the time, it would have been difficult to effect necessary repairs, and this might have caused great loss to stock dependant on watering-places where the pumping gear was out of order. The conditions surrounding these works have however altered so much since they were initiated that it is now well worth while considering whether water cannot be raised in a more economical manner than by the use of the whim, which under favourable conditions fails to utilize more than 50 per cent. of the horse power. The application of this power to pumping gear would give better results, and would not only be more economical in itself, but would very considerably lessen the cost of the shaft; for when double buckets were dispensed with the size could be very much reduced, lessening the outlay on both sinking and slabbing; the latter too would not be subjected to the same strains as with buckets working either on runners or with bumpers; strains, that in bad ground, especially running drifts, often lead to great expense for repairs and, in some cases, total abandonment of the work. The use of the horse as a motive agent, even when applied to improved gear should however be avoided as much as possible, as in bad seasons there are elements of uncertainty attached to it even as there are to its more economical rival wind. This agent has up to the present time not been tried by the Government on these works, and for the same reason that prevented it, years ago, adopting improved pumping gear; but the time has arrived when the primitive machinery of the past can be abandoned and more perfect appliances adopted, and in future works of this class, where the conditions are favourable, windmills and pumps will be provided instead of the whims now used for the purpose. Objections have been urged against the use of windmills for these works, on the ground that the wind might fail at the very time when a lot of travelling stock required water. This objection is perfectly valid; but the evil can be met by constructing larger service tanks, which, as there would always be water in them, might be made of puddled clay walls and bottom, which would without any increased cost provide a much larger surface storage to meet any sudden demand.

Before concluding these remarks on wells, it may be advisable to draw attention to the use that could in many cases be made of drainage shafts in localities in the dry districts where drifts are known to exist within from ten to twenty feet of the surface, are also known to have a limited area and to be influenced by the local rainfall. In such cases the power of storage could be very much increased by sinking shafts to tap these drifts in places where the surface features favoured the collection of either standing or running water, which would then discharge down

these shafts and be rapidly stored under favourable conditions as to temperature and evaporation, and at a depth from which it could be economically raised to the surface as required.

2. *Tanks.*

Most of the works for supplying the stock routes with water come under this head; and before describing the different types of tanks that have from time to time been adopted, it may be as well to give a short sketch of the conditions under which surface waters should be collected and conserved, and under which stock using these works should be supplied with water. In selecting a site for a tank the main points to be attended to are—that the area of the watershed will suffice, under the conditions of rainfall, to fill the tank and keep up the supply necessary to meet loss by soakage and evaporation and the demands made by stock traffic; that the nature of the surface of the shed allows of a sufficient proportion of the rainfall being available for storage, this being materially assisted by a proper system of gathering drains, by the fall of the country towards the tank, and by the consolidation of the surface by stock or otherwise; that the soil in which the tank is to be excavated is of a retentive nature; and in estimating this latter condition it must be borne in mind that many tanks which when first constructed lose water subsequently become thoroughly watertight, this result being due to the deposit of clayey silt brought off the catchment by the rains. Advantage should if possible be taken of the features of the locality to provide for a storage of water above the surface of the ground. This course, when it can be carried out, materially lessens the cost of the work, as a much smaller amount of excavation will suffice than where the whole of the storage is below the natural surface. This super-surface conservation may be effected either by gravitation or by pumping over the embankment enclosing the excavation. In the former case, which is of course the more preferable, there must be rising ground near the tank site, with a sufficient catchment above the level of the embankment to allow of the enclosed area of the tank being either wholly filled, or filled to a sufficient extent to warrant the expense of fluming. In the latter case the features, though not suitable for an over-bank discharge, must allow of a collection of water at the tank site which, after filling it to the same level through an inlet pipe, can then be pumped over the embankment into the tank.

When tanks are constructed in watercourses, the plan adopted by the Department is to make an embankment below the excavation; and in cases where the channel is shallow and the fall of the bed considerable, this dam is carried above the level of the creek banks, and flanking embankments carried on the same level as dam are continued up each side of the creek until they cut the

natural surface of the ground. In other cases, where the fall of the bed is inconsiderable, a dam is constructed both above and below the excavation, and these if raised above the level of the creek banks are joined by lateral embankments; an inlet pipe is laid under the upper dam, which allows water to gravitate into the excavation and enclosed space until it reaches the level of the water outside; a valve is then closed, and if necessary the outside water is pumped over the embankment into the reservoir. This plan, while giving a greater depth of water, at the same time shuts off the tank supply from that in the shallow reach above it, and considerably reduces the loss by evaporation and soakage. In all works of this character great care must always be taken to provide an adequate bye-wash, and, wherever it is possible, the work should be located to allow of a natural channel being used for this purpose.

The system to be adopted in watering stock at these works involves two questions of great importance; that of the economical use of the water; and the preservation of its purity as far as is practically possible when it is gathered off what must be to a great extent a camping ground. It may be laid down as a broad principle that, to attain these ends, stock must not be allowed to water *in* the reservoir; for the amount of water carried away by sheep in their fleeces, the amount of silt carried by them into the tank, and the pollution of the water by all kinds of stock when drinking are all so great that no arguments are necessary to support this view; and it was fully recognized by the Department when the first works were constructed. These tanks provided for independent watering, but subsequently many departures were made from the original design. These modifications, which will be presently described, were made to reduce the cost and to simplify the details as much as possible; the latter course being rendered all the more necessary on account of the heavy outlay that had to be incurred in repairing the older works which had been very inefficiently maintained.

The first departure made from the original design was to introduce a separate tank with flattish slopes for stock to water in; this being connected with the main tank by a pipe with a valve, so that the inflow of water to the drinking slopes could be regulated to the demand. The advantages claimed for this design are —economy in first cost, economy in maintenance, and simplicity of detail. The disadvantages, which overbalance the benefits are thus set forth by Mr. Bruce, the Chief Inspector of Stock (report for 1880):—"That a great deal of the water, as now supplied from them, is liable to be polluted and carried away by the stock wading into it, especially by sheep; that they are liable to be crushed and injured in crowding down into the drinking-tank;

and that the waste of water by evaporation is greatly increased by its being allowed to run into and stand in the drinking-tank." Mr. Bruce might have added too, that the inlet pipe from the main tank to the drinking-tank is very liable to be silted up and rendered inoperative.

On the Cobar to Nyngen Road the tanks are simple open excavations, in which all stock water direct. This is undoubtedly the simplestl and, in first cost, the cheapest form, but it is open to the objections previously urged as to waste and pollution of water, the latter too in an aggravated form which is very marked when the water is low. These tanks were constructed to meet the urgent wants of the Cobar township and mine, and to secure the trade from that important district for the Sydney market.

The last type of tank to be noticed is that adopted in the Bourke district, which, with a separate drinking slope, has an *open* communication with the main reservoir, through a box drain. This plan nullifies any advantages that might be claimed for the separate drinking-tank system as already described, and aggravates all the objections to it, reducing it in fact to a level with the open single excavations on the Cobar to Nyngen Road, with the added disadvantages, that the first cost—for equal contents—is greater, and the exposed areas for soakage and evaporation much increased.

The experience gained in carrying out these works has led to the conclusion that the system first adopted is that which, considering the greater facilities that now exist for obtaining skilled labour, and for transporting and repairing the necessary plant, should be adopted in all future works; and type drawings have been prepared which, while showing some alterations in detail, embody the same principles that were followed in the first works of this class carried out by the Department.

The main alteration in the details of construction is the employment of pumping gear in lieu of the M'Comas water lift. This avoids the necessity for a lot of submerged timber-work, which, in addition to being very expensive, is always an element of weakness; it also lessens much of the annoyance and inconvenience due to silting, which chokes the M'Comas lift but is avoided with our pumping appliances, by a floating suction pipe. Another alteration is the construction of a service tank to supply the troughing instead of connecting it direct with the pump. This gives stock a much steadier supply when they are watering, and provides a reserve to meet any sudden demand when the pumps are under repair.

The use of pumps for increasing the storage by lifting water over the embankments, in cases where it collects outside the works, has been considered and approved, but the power to be employed

has not been determined. In all cases where the conditions are favourable windmills should be employed; and in forming an opinion on this point it must be remembered that, as they are slower and more uncertain in their action than steam, they can only be advantageously used for feeding the main tank when there is a considerable collection of water outside the embankments. When this is not the case, more rapid pumping will be necessary, and then steam should be employed if fuel is procurable within a reasonable distance. Pumping appliances should be erected at each work, and used for filling the service tank, in addition to pumping water over the embankments for storage. This course is preferable to having a portable engine and centrifugal doing duty at the tanks along one or more lines; for in many instances fuel would be too distant from the sites to be economically used; the stages would be too long, and the delay as between one tank and another would mean the loss of the outside water, which if it collected in sufficient quantities to admit of such delay, should be pumped into the tank by wind-power.

Windmills, though they have not received much attention, and have been but little used in those districts, are destined to be extensively employed in lifting water both for stock and irrigation. When it is considered that there are very few days in the year during which good work could not be obtained from a well constructed mill—that the first cost is comparatively small—and that the after cost for work done is confined to the expenses for maintenance—it seems very strange that attempts have not been more generally made to utilize this power. When its value has been practically tested and the results are presented in a tangible form, there is little doubt but that it will be extensively used by all who are interested in the adoption of a cheap means of raising water, whether from wells or tanks, whether for stock watering or irrigation purposes.

Great difficulties are often experienced in letting these works, more particularly during dry seasons, when the want of water and feed within a reasonable distance of the tank site render it absolutely impossible to carry them out; and in other cases, somewhat less unfavourable, has increased the cost of excavation from 30 to 40 per cent. above the price for which it could have been done in good seasons. This is the necessary consequence of employing animal power in ploughing and scooping—though this system has very much reduced the cost of excavating and has almost entirely superseded manual labour. Attention has consequently been directed to steam power, and Fowler's ploughing and scooping plant has been successfully used for some time in South Australia. More recently the Messrs. Edols at Burrawang purchased and worked a similar plant on their property, where I saw it in operation in May last. The following extracts from my

report to the Department explain, from my point of view, the relative advantages of steam and animal power under varying conditions:—

"This plant consists of two 16 h.p. traction engines, with horizontal winding drums for working a double, three-furrow balance plough and an earth scoop. There is also an 8 h.p. traction engine for drawing water and firewood, and for assisting the main plant when travelling from one site to another. The cost of this on the station was about £5,000."

"The advantages claimed for this machine are"—

"1. That it is independent of the seasons, and able to work under conditions that would prohibit the use of bullocks or horses.

"2. That it is much quicker and more economical than animal power.

"3. That it is easily transported from one locality to another, and through country where bullocks would die for want of water and grass.

"In practice I think it will be found that these advantages are not fully realized, and that there are very important modifying influences to be considered.

"1. Though it can work under conditions that would prohibit the use of bullocks or horses, it is not fully independent of the seasons, inasmuch as it consumes about 1,800 gallons of water per diem, which is equivalent to what would be consumed by about 120 bullocks. Herbage or grass is of course not needed, and so far this plant is independent and is in a position to do work where animal power could not be applied; but firewood and water are as necessary for the engines as are grass and water for bullocks; and where these requisites are scarce, and have to be hauled from any considerable distance, the limit for the application of this machinery is very soon reached. In favourable country for running the traction engine I consider, from what I saw at Burrawang, that 20 miles would be about the limiting distance for haulage of wood and water; but in unfavourable country, that is, where the ground was loose and sandy or where it was boggy, the limiting distance would be much reduced, for in such ground the traction engine is unable to work, or works under such difficulties that its normal efficiency would be very much lessened.

"2. The claim for superior speed and economy can only be partially sustained. In bad seasons, when animal power could not be applied on account of there being no feed, and in places where firewood and water were within a reasonable distance by a sound track, the steam plant commands the situation; but in good seasons the work could be more rapidly carried out by bullock plants if the same capital was invested in them, but not at the same price, though even on this score there is not much to

be advanced in favour of the steam plant, as will be seen by reference to the following figures showing the cost of excavation by both systems:—

"Cost of steam plant £5,000

Weekly expenses—

1 engineer and manager ...	@ 80/ =	£4	0	0
3 drivers...	@ 30/ =	4	10	0
1 steersman	@ 25/ =	1	5	0
1 scoopman	@ 30/ =	1	10	0
1 clearer (for rope)	@ 25/ =	1	5	
2 woodcutters...	@ 20/ =	2	0	
1 cook	@ 20/ =	1	0	
10 rations	@ 12/ =	6	0	
Oil, &c.		0	10	0
Interest @ 8 per cent....		8	0	0
Depreciation @ 12 per cent. ...		12	0	0
Total		£42	0	0

"The work done in a week is equivalent to about 2,500 cubic yards, which makes the cost 4d. per cubic yard.

"This estimate of cost is based on the supposition that there are no stoppages and that there is no delay between one tank and another; but, as a matter of fact, there are many stoppages and much delay in transporting plant. This latter element of loss increases to a great extent in sandy country or in wet seasons, when the bullock plant is most favourably circumstanced. Taking these disturbing elements into consideration, we must fix the price of the work done at a much higher rate. I estimate that only thirty-four weeks in each year can be relied on for work, the balance being required to cover the various unavoidable delays. This affects the estimate of cost to a considerable extent; for with a plant of this character, requiring trained men to work it, no reduction can be made in the weekly expenses during the time it is idle; consequently we have fifty-two weeks' wages, &c., at £42, representing thirty-four weeks' work at 2,500 cubic yards a week, or 85,000 cubic yards, costing £2,184, being at the rate of 6d. per cubic yard.

"Cost of bullock plant... ... ... £1,300

Weekly expenses—

1 manager	@ 60/ =	£3	0	0
5 bullock-drivers	@ 30/ =	7	10	0
2 ploughmen	@ 30/ =	3	0	0
5 scoopmen	@ 30/ =	7	10	0
1 tailer	@ 25/ =	1	5	0
1 cook	@ 30/ =	1	10	0
15 rations	@ 12/ =	9	0	0
Interest @ 8 per cent....		2	0	0
Depreciation @ 10 per cent.		2	10	0
Total		£37	5	0

"A strong plant like this could excavate about 1,500 cubic yards in a week, which would cost 6d. per cubic yard.

"This estimate, like that for the steam plant, requires modification, as the bullocks could not, for various reasons, be constantly worked. Estimating the same loss of time, which taking the average run of the reasons is I think equitable, and we have—

34 weeks' work	@ £37 5 0 =	£1,266 10 0
18 weeks' idle time... ...	@ £18 0 0 =	324 0 0
		£1,590 10 0

"This amount represents thirty-four weeks at 1,500 cubic yards a week, or 51,000 cubic yards, and the cost per yard is about 7½d.

"From this it will be seen that the same amount of capital invested in bullock plant would give a much larger output while at work, but at an increased cost of 1½d. per cubic yard. Could the seasons be relied on, there is little doubt that animal power would be preferable to this form of steam plant, as the extra cost by bullocks is fairly balanced by the risk of breaking down, &c., which in the out of the way places where this machinery would be employed, would entail great loss of time and money, and very soon cover the small margin of difference in favour of steam.

"When, during long continued droughts, it is impossible to employ animal power, and when water and fuel are available for steam, then this plant comes to the front and offers the only practical means of tank excavation."

Another excavating machine, invented by Mr. Waugh, is now at work near Sydney; and though it does not avoid the necessity for employing horses and drays to remove the material, promises to very greatly reduce the cost of "getting." It has the advantage of being less cumbersome than the ploughing and scooping machinery, is much less costly, but is far more limited in its application. The patentee is perfecting the machine, which, being constructed on a new principle, has naturally exhibited some defects. When these are remedied, it promises to be a valuable addition to the resources at our command for reducing the cost of excavation either in tanks or canals.

II.—Water Supply for Irrigation.

There are few questions of such importance, few questions with which the future prosperity of this Colony is so intimately interwoven as that of irrigation; and considering the extent to which works of this character will promote settlement and mitigate the uncertainties that now attend both pastoral and agricultural occupation, it seems strange that no steps have been taken to ascertain to what extent and at what cost the rainfall of this Colony can be conserved and distributed over the waterless areas of our western sheds, where a rich soil now lying fallow, only waits its invigorating influence to yield returns that, with the climate we possess, would convert it into a mine of wealth. Surveys that will require

years to complete, and that are essentially necessary to assist in framing a comprehensive scheme, are not even commenced, and the time must be far distant when we shall be able to lay claim to having taken the first great step towards developing the wonderful resources of our lands. It cannot be said that attention has not been drawn to the advantages to be derived from such works, for seventeen years ago, when giving evidence before the Board appointed to inquire into the Moama and Deniliquin railway scheme, Mr. W. C. Bennett, Commissioner and Chief Engineer for Roads, drew attention to the yearly waste of water brought down by our western rivers, and the practicability of employing it for irrigation purposes. The Commissioners appointed to inquire into a water supply for Sydney and suburbs, in their report thus allude to the subject:—"Although our commission limits us to an inquiry into the supply of Sydney and suburbs, we have not been unmindful of the great desirability of obtaining such a plentiful command of water as would permit of its free use in irrigation; not only in the immediate neighbourhood of Sydney, but also over some considerable portion of the county of Cumberland. We feel convinced that this question of irrigation ought no longer to be neglected. Our comparatively dry climate, coupled with the very unequal and uneven distribution of rainfall, point imperatively to the necessity for making provision for storing up the superabundance of rain that occasionally falls, that it may afterwards be dispersed to the thirsty soil as required, and thus secure fertility and plenty in all seasons." Time after time have letters and leading articles appeared in the public journals drawing attention to what has been done and gained by such works in other countries, and showing the necessity of action if we intend to avail ourselves of the latent wealth at our feet; but in even plainer language and with practical force has Nature herself indicated what water can do in the dry districts, and how readily, if conserved and at our disposal, it can be distributed over the face of the country. In proof of this I instance the spread of the flood-waters of the Murrumbidgee, Lachlan, and Darling, in 1871; the network of connections between the Bogan, the Macquarie, and the Castlereagh Rivers, in the counties of Clyde, Leichhardt, Gregory, &c.; the water circulation in North Gipps, which, with many other instances, point in no unmeaning manner to the facilities offered by the natural features of the country for distributing the supply brought down by our rivers, and for pouring living streams of water over the thirsty plains. Yet notwithstanding all this, season after season as it rolls by shows us our rivers, fed from the higher lands by the greater rainfall, by melting snows and by springs, carrying the life-blood of the country through the very districts where its fertilizing agency is a necessity to success, to discharge it to waste in the ocean; while those who have eyes to see, and *must*

see the incalculable advantages that would accrue from utilizing it look on and abuse Nature rather than exert the powers they possess and assist her to assist them.

The conditions surrounding this problem in this country are widely different to those which had to be dealt with in India and Southern Europe; there a teeming population made it necessary that increased and certain returns should be obtained from the soil, and there as soon as the facilities for obtaining water were afforded they were immediately taken advantage of, and thus, both by direct and indirect returns, enterprise in this direction was encouraged. In the former country, though much remains to be done, it is almost impossible to over-estimate the blessings that irrigation works have conferred on the people, improving both physical and moral tone, and to a great extent mitigating the evils that in a densely populated country attend a failure of the crops that form the great staple of life. In this country, instead of having a large population settled on the soil requiring the assistance offered by such works to meet their wants, we have an immense territory possessing a soil capable of growing any products suited to the climate, which is now little better than a huge sheep-walk, but which is capable of being converted into great agricultural districts capable of supporting thousands where now it is difficult to count tens. This paucity of population has been urged as an argument against such works being undertaken, the inference being that population must precede irrigation. This means that irrigation will never be carried out on the great western plains, for I maintain that in the Riverina districts irrigation works must precede settlement, that is, settlement on any but a pastoral basis. To those acquainted with these districts this must be obvious, for without water agriculture is impossible, and except in certain confined and favoured localities, it is impossible for irrigation to be applied to any agricultural holding by ordinary private enterprise. The pastoral tenant—the sheep farmer—can provide all the water he requires for his flocks by local conservation in tanks and by wells; but the large quantities of water required for crops cannot be locally conserved in the flat country, while to obtain it from distant sources means an expenditure of capital far beyond the abilities of any agriculturist, and far in excess of any returns that could possibly obtain from individual holdings. Maintaining these views, I fail to see how the hopes entertained as to settlement on a large scale, following on the liberal railway policy pursued in these districts, can possibly be realized; I fail to see how, unless water is at our command, the lines constructed, being constructed, and those proposed, more particularly the latter, can ever carry much besides pastoral produce. Whether railways through these districts will pay under such conditions remained to be proved; but

that they would do so were a population settled on the country, actively engaged in cultivating the soil, does not admit of a doubt, any more than does the fact that, taken in connection with a water supply, they would have an important bearing on settlement in such improved districts, by the facilities they would give for distributing produce grown in those districts.

Believing as I do, that in those districts, the construction of the main channels for distributing water must precede settlement, it follows, that for some time after their construction they will have a more important bearing on pastoral than on agricultural occupation; and though, even from this narrowed view of the question, they will be of immense importance, it cannot be expected that they will prove remunerative until they are utilized for the more comprehensive objects for which they were constructed. The advantages to be derived from such works by the sheep-farmer are manifold, and in themselves well worth consideration. Prominent amongst these are—the direct facilities that would be afforded for watering stock by giving new frontages along the arterial channels, while the benefits from this source could be much increased by cutting distributing channels to feed tanks off the main lines, and by turning surplus waters into the many natural hollows existing in those districts. A great saving of feed would result from this, by allowing of a more equable distribution of stock and by lessening the distances they would have to travel between feed and water. Such channels would also aid in keeping communication open in all seasons, and thus allow, should occasion arise, of the transfer of stock from less to more favoured districts, and materially lessen the enormous losses to which pastoralists are liable during droughts. Nor must it be forgotten that these channels would in their districts afford the means of mitigating to a greater or lesser extent the evils attending droughts, by the facilities they would give for growing artificial crops, which being stored during good seasons would materially assist in meeting the wants of stock during bad seasons.

One of the first steps to be taken or that, judging by the benefits that are likely to be derived from a comparatively small expenditure, should be taken, is to assist Nature where she has defined the course of the waters during flood-times, and improve the *régime* of the overflow channels from our rivers, such as the Merowie, Middle Billabong, and Willandra from the Lachlan; the numerous creeks leading from the Macquarie to the Bogan; the various channels forming a natural system of distribution in North Gipps; and many other cases, all of which are capable of being made of immense service to their respective districts. These watercourses should be straightened and improved, so as to admit of an inflow at a lower flood-level, and to allow of a larger body of water being carried down them during the comparatively short periods when

the rivers afford a gravitation supply: these periods should also be lengthened by the construction of weirs. Branch channels should be cut to divert flood-waters from the rivers and overflows into the numerous lakes, swamps, and natural depressions found in those districts, which could in many cases be utilized, not only for the benefit of the adjoining lands, but also as reservoirs to make good the loss from various causes in the overflows, &c. The advisability of carrying out this latter work would of course be greatly dependent on the advantages to be derived as compared with the cost of cutting the feeders, but as these could be utilized along their courses, the distances of these natural reservoirs from the point of diversion becomes a matter of less importance. Sluices would necessarily be required to regulate the waters and to prevent a back flow when the rivers fell. Private efforts have been made in some few instances to attain these ends; inlets have been cut from the rivers to these secondary channels, which, generally speaking, are more imperfectly defined where they leave the rivers than they are further on in their course; but most of these efforts have failed to fully realize the expectations of the promoters—failed because, though admitting the river waters at a lower level, the channels below the inlet improvements were left unaltered and only capable of carrying the water forward at the velocity due to their natural *régime*, this velocity being very small, on account of the sinuous course of these creeks through a comparatively level district giving a much lesser fall than that of the country on the general direction of flow. Much could be done in this direction by judiciously planned works—done, too, with a very moderate outlay; and though these improvements would have a limited application to irrigation, they would yet assist in that direction and would be of immense benefit to the pastoral industry, and would greatly increase the value of the Crown Lands and the rents that ought to be derived from them; and when, later on, they were connected with a more perfect scheme, they would be as valuable to the agriculturist as in their earlier stages they were to the sheep-farmer.

The important bearing of these channels, &c., on the water supply for the districts they intersect points to the urgent necessity that exists for taking prompt measures to reserve from sale all lands adjacent to them, that, under normal conditions, can only be utilized for grazing, but that would be valuable for agricultural purposes when provided with a certain water supply. This course should also be adopted under similar conditions of settlement on all belts of country where, without survey, there is sufficient reason to think they can be brought within the scope of any general scheme of irrigation. This course will be necessary to prevent the improved areas, or the areas proposed for improvement, being alienated for purely pastoral purposes, and to ensure

that the Colony generally shall reap the full advantage of the increased value of these lands—an increased value that should be credited to these works, and which, while recouping the country for a considerable proportion of the outlay, would at the same time practically prohibit these areas being devoted purely to grazing. The increased cost of such land would also have the effect of making the holder more rapidly develop its capabilities and would ensure every advantage being taken of the irrigation works, without which the cultivator could not rely upon a return for his labour and capital, and without which these works could not be expected to prove remunerative.

In considering this question from a general point of view, it must be borne in mind that as the features of the country to be dealt with vary, so may there be room for an equal variation in the nature of the works best adapted for the object to be attained; and it will therefore be advisable to divide the subject into two main branches, dealing separately with irrigation derived from local sources, and with that derived from our great rivers; not forgetting that many cases may arise where the supply obtained from the former could be largely aided by the latter, and *vice versa.*

The country to be dealt with consists in the west and south-west of extensive plains, broken here and there by sand-hills and low ranges, and with a small fall in the direction of drainage, but nearly level transversely to such lines, except where watercourses and ridges are intersected. To the eastward the ranges become more frequent and of greater magnitude, gradually culminating in the coast range which divides the eastern and western watersheds. The rivers and their earlier tributaries have a considerable fall in their upper courses, but this gradually diminishes as they run westerly, till in the plain country it does not much exceed 4 inches in the mile, but as the bends give a river length roughly estimated as being three times greater than that of a direct line the fall of the country would be about 12 inches per mile.

The rainfall over these districts varies very much, being dependent to a great extent on the features of the country and on position in regard to the main coast range, where the fall is heaviest. From this range there is, with some slight local irregularities, a marked decrease of the rainfall as we advance westwards. The nature of the rainfall is not only spasmodic in its annual amount, but is equally fitfully distributed over each year. This has an important bearing on the proportion that is converted into running water, and that can be conserved for future use, as also on the loss by evaporation; this must be greatest on the low-lying western plains, where the ground has a high temperature and the winds are very dry and act very continuously. The loss from this cause must attain its maximum when the annual fall is so

distributed that the minimum of running water is formed, when, consequently, there is no concentration of rainfall off large areas to reduce the evaporation surface, and to further lessen loss by the difference in the rate of evaporation off a water surface as compared with that off the soil. In such cases I can readily understand that were the supply kept up under equally favourable conditions for the whole year, we would have fully 20 feet to record as the result. But unfortunately we have no data on this point, any more than we have as to the proportion of this evaporation that may be given back by condensation in other form than that of rain. But although these data are not at our command, and as it is consequently impossible to arrive at definite conclusions as to the exact number of inches, we must make the measure of evaporation in different localities; and although we admit that where light recurrent rains fall on a baked and heated ground surface, and are exposed to hot and thirsty winds, the evaporation must be enormous, I yet think we are justified in taking more hopeful views as to the possibilities of irrigation than has been done by those writers who have *lately* made a bugbear of the evaporation question, and have tried to prove that it must render any irrigation scheme impracticable. It cannot be denied that in the eastern and hill districts of this watershed the rainfall is greatest, and evaporation much less than on the plains; that the incline of the country favours a rapid concentration of rainfall, giving water surfaces of limited area for evaporative agencies to act on. In these districts the rainfall must be impounded for after distribution through artificial channels; and while so concentrated, the loss by evaporation need not trouble us here much more than it does in other dry countries, save that we have not as copious and constant a supply to draw on as other countries have had for their irrigation schemes; but when concentration ends, and the water is discharged over the surface to be irrigated, then the loss from this cause will be heavy; but it still remains to be proved whether a 2-inch watering, even admitting the rapid loss, will not produce as great a vegetable growth with the forcing climate of our plains, as the same amount of water where the heat and evaporation are less, and where the water remains longer in the soil. Judging by the wonderful effects produced by even half-an-inch of rainfall in the same country, it appears probable that the rapid loss by evaporation is in a measure made up to us by the equally rapid growth of vegetation. Should this view be incorrect, is the loss through evaporation so *much* in excess of what it is in other dry countries, that we should at once despair? I think not. The loss from a water surface in Bombay has been estimated at about 6 ft. per annum; in this Colony, at Bourke, Mr. H. C. Russell estimates the evaporation at about 7 ft. Presumably the evaporation off the soil, as compared with that off water, will bear the

same proportion to one another in both countries, in which case our position is very little more unfavourable than is that of India, where irrigation has been carried out on a large and most successful scale.

From the foregoing it will be seen that there are two classes of country for us to deal with: that on the middle levels, where the rainfall is, taking an average of years, fairly abundant, where the evaporation is not very great, and where the slope of the country is sufficiently marked to convert a large proportion of the rainfall into running water, which, under normal conditions, is rapidly carried away by creeks and rivers. The other class is on the level lowlands, where there is a minimum of rainfall, a maximum of evaporation, and so little incline, that under ordinary conditions of rainfall but little running water is formed.

Local conservation of rainfall for irrigation purposes can only be adopted in the hill country, where the natural features offer facilities for storage. The works for this purpose, which in India are called tanks, have been largely used in that country from time immemorial, and great benefits have been and are still being derived from improvements of this class. In the Madras Presidency, in 1853, there were, according to Captn. R. Baird Smith, no less than 43,000 tanks in use, and 10,000 more which had been allowed to get out of repair and were of no service. In forming an opinion of the amount of work involved in the construction of these reservoirs, it must be remembered that the word "*tank*" has a much broader significance in India than it has in this country, where they are little else than excavations, few of which contain more than 20,000 cubic yards; *there*, tanks are large reservoirs conserving enormous bodies of comparatively shallow water, which is impounded by embankments. The Ponairy tank in Trinchinopoli covers an area of about 80 square miles, the embankments being 30 miles in length; while the Veranum tank has an area of 35 square miles, and embankments 12 miles long. Similar works could be constructed in this Colony, and a large proportion of the rainfall locally conserved and distributed. Dams could be thrown across valleys and basins, and, where the drainage from the watersheds naturally feeding these reservoirs was insufficient, channels could be cut to bring an extra supply from some adjacent shed, or, in many instances, could be made to divert the flood-waters from neighbouring creeks or rivers. By such means as these the evil effects of our spasmodic rainfall could be mitigated in the improved districts, and isolated areas of rich land made permanently reproductive and independent of the seasons in localities which could not be brought within the scope of a general scheme, either on account of the levels being unfavourable, or on account of much valueless land having to be traversed by the canals before the district to be irrigated could be reached. In such cases the cost of

bringing water from a distance might be prohibitory, and then the only courses open would be to take advantage of local supply, to trust to the seasons, or to abandon the ground for agricultural purposes. The first of these alternatives can only be successfully followed when the rainfall and catchment area are sufficient to provide the necessary supply, and when the natural features offer facilities for storage and distribution at a cost that will allow of the water being made commercially reproductive; the second alternative of trusting to the seasons seems to be born of the happy-go-lucky style of farming so general in this country, and which, unless in particularly favoured districts, or in favourable seasons, is as general in its failure as in its adoption. The last is often the natural sequence of the second alternative, and in far too many cases for the interests of the community has this been the result of undertaking agriculture under conditions that without artificial regulation are too unfavourable to allow of success; the consequence being that these lands, rich though they may be, revert to the Crown, or are absorbed into some large pastoral estate, the selector and would-be farmer having wasted not only his small capital but some years of labour which could have been more beneficially employed in other channels. Amongst the many advantages to be derived from *local* conservation, is the fact that there need be no such delay in providing the necessary supply as would be the case if the lands to be dealt with had to wait until they could be brought within the scope of a general scheme, and this advantage is increased by the fact that such works could be undertaken by district Boards, whereas the larger and more comprehensive scheme, being national in its aspect, would have to be dealt with by the central authorities. The important bearing of such local works on the wellfare of the country is very forcibly shown by the concluding remarks in Captain Smith's report on irrigation in the Madras Provinces. He says: "I cannot close my report without reverting for a moment to the field of improvement presented by the Presidency of Madras in the single department of irrigation. In all parts of India, profit to the State and the people follows, as certainly as effect follows cause, the provision of an abundant supply of water for agricultural purposes, but in Madras the results go far beyond the general average. The staple of agriculture in the irrigated districts being rice, the want of water brings with it abject poverty and discontent, its abundance wealth and contentment. Every acre that is newly watered passes at once from the revenue rate of dry, to that of wet cultivation, guaranteeing to the Government an immediate return, paid with far greater ease to the cultivator of the land than the lower tax leviable before. The return is immediate, and its amount great. I have almost hesitated in adopting the data given by the Madras Commissioners of Public Works, so extravagantly large do they

appear; but they are statements founded on official returns, open to verification, and unlikely to be seriously in error. When these show returns varying from 77 to a maximum of 259 per cent. on the original cost of the works, it is inconceivable that fields parallelled only, if parallelled at all, by those of Australia and California, can be left much longer unwrought."

This description, however true it may have been in its application to the districts alluded to at the time it was written, is scarcely parallel with the conditions surrounding the question in this Colony; but after making every allowance for sparse population, high priced labour, and distant markets, there is much still left to excite hope and sustain the belief that the time has arrived when irrigation works should be initiated; and that in the years that must elapse in carrying them into complete effect, settlement will be borne steadily forward on the living streams distributed through the thirsty land; successful settlement developing the latent wealth of the Colony and ensuring a grand future of peace and prosperity.

The local conservation we have been considering, though it must have a great influence on the advancement of agriculture, is secondary in extent and importance to the supply offered by our river systems, on which we shall have to depend for irrigation in the low country, or for providing water for any comprehensive scheme; and sooner or later active steps will have to be taken to draw these waters into our service, and so utilize them that they will lessen the loss and misery attending droughts in the pastoral districts, increase the stock-carrying capacity of the country, and develop the extraordinary but latent agricultural resources of districts where an unrivalled soil and climate will yield abundant returns to reward our enterprise. To attain these desirable ends water and population are necessary. The former we possess, and it only needs capital and skill to divert it into channels where it will be at our command, a potent power in the advancement of the Colony, instead of being carried wastefully to the ocean, a practical satire on our plaints and prayers: the latter—population—must, as far as the dry districts are concerned, follow, not precede, such works; and there is little doubt that when water is obtainable for irrigation, agricultural settlement will certainly follow, more particularly as the preliminary cost of preparing the surface will be much less than what it is in many other countries, both on account of its natural evenness and on account of the small quantity of timber to be dealt with.

The few attempts at irrigation that have been made in the Riverine district have been conducted under great disadvantages, as the water has been pumped from a low level, and the cost consequently increased to a very great extent; notwithstanding this great drawback the results have been very satisfactory, and point in a most unmistakable manner to the benefits that must be derived

from the construction of works that will deliver the required supply by gravitation. The following extracts from a letter kindly written by a gentleman who is intimately connected with one of the largest pastoral properties on the Murrumbidgee, needs little comment, except to draw attention to the fact that the water was raised by steam power, and that the cost of irrigation on which the writer's opinions are based, was much in excess of what it would have been under a properly carried out scheme delivering the water by gravitation, and also much in excess of what it would have been with steam pumping, had there been weirs to raise the water level and reduce the lift. This gentleman writes as follows: "Some years ago I ploughed up about 10 acres near a lagoon on this station and sowed a portion in lucerne, a portion in prairie grass, a portion in maize, and a portion in oats.

"The soil, although rich enough, is rather stiff and clayey, and it was very imperfectly broken up when the seeds were sown; the consequence being that the crops came up very unevenly, but all the plants that did come up grew very luxuriantly.

"I irrigated the patch by pumping the water by means of a 12-inch centrifugal pump, and a 12-horse power engine from the lagoon into a raised channel carried round the higher side of the land; from which channel the water was allowed to overflow, by making breaches at intervals in the bank, spreading itself about until all the land was saturated. The ground is almost a dead level, so that there was little difficulty in distributing the water over the surface.

"I watered it about five times during the summer months, giving it on each occasion a soaking which I should think equal to 2 inches of rain or thereabouts.

"The maize crop grew well to a height of 8 or 10 feet, and the cobs of corn were of good size, but I kept no record of the quantity gathered. The lucerne and prairie grass were fed down with sheep, and the oat crop, a very fine one, was cut down for hay. The lucerne is still growing, and thrives well. The prairie grass died out last summer, when I did not irrigate it.

"The primary object of my experiment was attained in satisfying me that crops of all ordinary kinds suited to the climate can be grown in great abundance in this district by means of irrigation, but I could not pretend to give anything like an accurate estimate of the cost per acre of laying down and watering, or to speak with anything like authority as to the profitableness or otherwise of the work.

"I am inclined to think that ordinary agricultural products of a compact and easily transportable kind, such as flour, would be more cheaply purchased elsewhere, and brought down by rail, than grown here under irrigation, but that irrigation might be profitably

used for producing hay, which is bulky, and consequently expensive of carriage; or for raising potatoes or roots which are perishable, or green stuff to feed valuable stock on in time of drought.

"I think also that wine-growing might be profitably carried on under irrigation, as vines thrive very vigorously here when liberally watered, and produce grapes of great richness and flavour.

"One thing I may mention which may appear somewhat incredible to people who have seen the Murrumbidgee River only in time of flood, viz., that I think the supply of water in the summertime would sometimes be found inadequate to very extensive irrigating operations.

"The stream is frequently, from January to March, so shallow that a horse may ford it without wetting his knees, and of no great width; and from the quantity of water I have myself pumped up with one engine and pump for irrigating and sheep-washing purposes, I feel sure that if 500 or 1,000 other people were each withdrawing a similar quantity of water from the river, the stream would be found insufficient.

"This drawback could of course be obviated by the construction of weirs to impound large quantities of water in the channel and prevent it from running to waste; but this work would probably be found too expensive to be undertaken until the country becomes very much more thickly peopled than it is likely to be for many years yet."

From the foregoing extracts it will be seen that the writer only tried and only formed an opinion on the profitableness of irrigation from the results obtained with the everyday agricultural products of the Colony; but, great as would be the advantages of extending the cultivation of such products into the dry districts, they would be insignificant when compared with the returns that would be obtained from the more profitable cultivation of plants that are more particularly adapted to the Riverine climate, such as indigo, madder, chardon, hemp, limes, olives, &c.

The concluding paragraphs of the letter have an important bearing on the question; and, before proceeding further, it may be well to consider the nature of the rivers from which our supply must be drawn, and the conditions under which water can be stored and diverted for distribution. As has been previously remarked, the fall of the rivers, which is very slight in the lowlands, increases considerably as we trace them towards their sources. Another feature is, that where they have the greater fall they run through deep and comparatively narrow valleys, bounded by ranges of considerable abruptness, and generally of a rocky, barren character; that when the fall is slight, there they run in deep-seated beds through a plain country, over which the waters spread for very considerable distances during floods. The quantity of water brought down by these rains is, on account of the

spasmodic nature of the rainfall, very variable; some seasons give a full river for months at a time, while there are equally long periods during which the flow is insignificant. To meet these variations and to equalize the supply that must be provided for irrigation, impounding works are the first necessity, and there is little room for doubt that this must be carried out, not only in the comparatively level reaches of the rivers, but more particularly in the middle and upper courses of the main channels and their tributaries. Many of those who have interested themselves in the question consider that weirs in the lower courses of these rivers, impounding water on the frontages of the lands to be irrigated, will meet the requirements of the case; but a little consideration will show that any such limited supply would be quite inadequate for any broad irrigation scheme, and that the cost of the works to carry such a plan into effect would be out of proportion to the benefits derivable from it.

The quantity of water annually required may be estimated at 12 inches, being six waterings of 2 inches each. This amounts to 43,560 cubic feet per acre. Assuming the river to have an average width of 150 feet, and that the depth maintained was 20 feet, this would give a storage of 15,840,000 cubic feet per mile of river channel, and would provide for the irrigation of 360 acres, or a strip of land on each side of the river about a quarter of a mile in width. It may be said that no account has been taken of the occasional supply brought down, and which would refill the ponds; but as there *are* seasons when no such supply could be relied on, and as irrigation to be successful must be certain, I have left this out in my estimate. The expense of constructing weirs and, on our navigable rivers, locks, for maintaining traffic, would be out of all proportion to the advantages derived; for even then the water would have to be raised by steam or wind power. The construction of weirs in the alluvial country characterizing the lower reaches of the western rivers of this Colony would be a very costly undertaking, on account of the difficulties that would be experienced in protecting such works from scour. Exceptional cases might arise where rocky bars would be found crossing the rivers, on which such works could be securely founded, but these cases would be few and far between, and can almost be neglected in considering the subject. It may possibly be urged as against the objections now raised, that the expense of constructing such works could not be charged in its entirety to the irrigation funds, inasmuch as with locks in connection with the weirs permanent navigation would be established, and this should be debited with a portion of the outlay. This, however, cuts both ways, as it reduces the quantity of water at disposal for irrigation by the depth that would have to be maintained for navigation; but apart from this, it is worth consideration whether, if such improvements are ever considered

advisable, lateral canals would not be found preferable to improving the existing channels, with their tortuous courses; with the large supply of water required to provide for their unnecessary length and width; and with the constant difficulty of maintaining such works in flood-time. Taking all these points into consideration, such a system for irrigation supply must be discarded, though, *in connection* with the impounding operations that should be carried out in the upper reaches, weirs might be of modified use on the lower levels for assisting in the diversion and storage of water.

The great object to be attained is to provide a steady, certain supply that can be distributed by gravitation, and, to compass this, a sufficient body of water must be stored in the upper courses of the main rivers and their tributaries to provide a supply during the season of least rainfall, when the natural flow would be insufficient; and having made this provision, to construct canals to receive and carry into the dry districts the water so stored. The upper and middle, or upper-middle courses of the rivers to be dealt with, are far more favourably circumstanced for economical storage and diversion works than they are on the levels; for the fall, though not too great to allow of moderate impounding works throwing back the water to a great distance, is yet sufficient to allow of the water being readily diverted from the natural channels into artificial canals excavated for the purpose. The valleys through which these rivers pass are in many places very much contracted, the waters running through narrow gorges which open out above into large basins. These sites offer favourable opportunities for constructing weirs, the foundations on these sections of our rivers being of a sound character, and no difficulties likely to arise from the flanking action of scour. Enormous bodies of water could be stored in such places without any disproportionate expense being incurred, and in some cases with a very small outlay. The tributaries to these rivers would have to be similarly dealt with, means being provided in each case to allow the impounded waters to be discharged as required, so that any surplus over what would be needed for merely local wants could be passed down to supply the lower ponds where the water was being drawn off by the main canals, and those ponds still lower down where, either by steam or wind, water was being raised for irrigation along the rivers.

The preceding remarks are necessarily of a merely general character, for the data at our command are of such a very meagre nature that it is a matter of impossibility to formulate any scheme. Before this can be done, careful observations must be made of the discharge of our rivers at different points, and extensive and accurate surveys prepared, showing the quantity of water we can command and the cost of the works for conserving and distributing it. Until this is done any views on this question must be vague and ill-defined; but we know enough of the conditions

under which irrigation will have to be carried out in this country, and under which it has been carried out in other countries, to enable us to take a practical view of the question as a whole; enough to protect us from being carried away by the mad enthusiasm which pictures the whole of the dry country converted into a garden of Eden, and, at the same time, protect us from the baneful workings of those who handle our rainfall and evaporation as weapons of attack with which to rout those who earnestly desire to see this country benefited by a wise use of those blessings we have too long neglected. For the present we must wait, wait patiently but not without hope, for the first steps to be made to carry out the necessary surveys in connection with, at least, one of our rivers, and to obtain other necessary data on which to frame some tangible, practical scheme.

Discussion.

Mr. Russell made the following statement :—

After trying for five years to call attention to some important questions affecting the water supply of the interior, it is gratifying to me that some of those who are qualified by their professional training as engineers to take up the subject are turning their attention to it. Before making any reply to what has been said against my views, I should like to take this opportunity of saying distinctly that I do not claim to be the first to raise the question of underground water-supply. From time to time I see in the daily papers that Mr. A. started in 1868, and again that Mr. B. was first in 1876, and so on. Who was the first I will not venture to say; but from my childhood, when I heard this matter talked about in my father's house, onwards for the last forty years, I have heard one and another propounding their views on water supply for the interior, and probably the first man has now ceased to take any personal interest in the matter. I merely came forward with measures of rainfall and river discharge, and pointed out the startling difference that exists between them. I said just now that I was pleased to see professional men turning their attention to the important subject of water supply for the interior, but I must add that I am somewhat disappointed. My hope was that they would marshal the great multitude of facts now floating about in reference to our water supply into such an order as would tell us plainly many of the things the public are so anxious to know; but instead of this I am told that I am wrong in my estimate of evaporation, that it is much more active than I suppose, and that the rivers run in such impervious clay that they can lose but very little by percolation. This is no answer to what I have said—in fact it rather strengthens my position. The bulk of the rainfall on the Darling is what

may be called heavy rain, and from the nature of the country it must get into the watercourses within a few days at most, so that its loss by evaporation must be confined to the narrow limits of the channel in which it runs. Of course the two-thirds of the rainfall which I have supposed is taken up by the ground will get the full effect of evaporation from soil all over the surface, but our present concern is with the part of the rain, say one-third, which finds its way into the watercourses. What becomes of it? Does it go by evaporation? In the hottest part of summer the loss from this cause is not more than a foot per month from a water surface, and this will be the loss all over the running water, and it forms but a very small proportion of the running water in the rivers, which in flood, when the bulk of the water passes down, are often 20 and 30 feet deep. At most it comes to this,—that in the hottest part of summer the river would lose about 1 foot while the water ran from its source to Wentworth; in autumn, when the bulk of the water passes down the Darling, the actual loss would not be more than 3 or 4 inches in a month, a quantity which does not approach 1 per cent. of the rainfall for the month; and what we have lost is from 10 to 15 per cent. of the rainfall, so that evaporation has not taken it. I have been repeatedly asked why I take 30 per cent. of the rainfall as the proportion of rainfall which would get into the streams in the upper and hilly part of the Darling basin; where the rain is heavy, and the watercourses abundant, I have simply taken what seemed from experience elsewhere to be a probable quantity; and have based the calculation upon this merely to show that such an estimate was absurdly in excess of what does actually flow down the Darling. But only to mention a few authorities. Rankine, in rules and tables, gives for Britain the ratio of available total rainfall on moorland and hilly pasture as from 60 to 80 per cent. In Germany five experiments upon rivers and seven on artificial drainage boxes gave 47 per cent. In the investigation of the rivers for Sydney water supply by the Royal Commission it was shown that in a dry year 39 per cent. of the rain passed down the rivers, and in winter 54 per cent. I have heard that more recent measures gave 44 and 52 per cent. respectively. An attempt made to get this information from Lake George gave the percentage as 30. A professional man here has estimated the percentage for the best-drained parts of the Darling country as 25. It was shown by the Royal Commission on Floods in the Hunter River that in a steady rain, after the first day, 75 per cent. of the rainfall found its way into the river. Now, I may as well add, for comparison, what my figures show as the percentage of rain passing down the Darling, and they are certainly in excess of the truth. In 1880, less than 1 per cent. of the rainfall passed Bourke; in 1881, less than a tenth of 1 per cent. (0·08); and in 1882, about

½ per cent. found its way past Bourke. Let us assume that the experience of engineers in Europe and in our own coast rivers is inapplicable to rivers in the interior, the difference shown above is so great that I think there can be but one explanation of it, and that is that much of the water must get away below the surface. But let me mention a few facts from experience that seem to have a direct bearing upon this supposition. I must select from a great multitude already published, and which I hope some one will classify. Should I take some that are familiar to you, please take them simply as indicating the idea I want to bring before you, and not as facts interesting in themselves. It will be seen that we have positive evidence of deeply buried river courses and of artesian wells that show no signs of decrease after fifteen or twenty years' use. If we know of several subterranean water-courses and several artesian wells which after many years' use are as full-flowing as ever, it is surely premature to say that the water cannot flow underground, and that the wells must fail. At Laen, in the Wimmera district, Victoria, which is part of the great plain of the Murray and Darling, a bore was put down for water, and 250 feet from the surface the bore passed through a tree a distance of 6 feet, and several fruit stones were brought up in the borings, the stones being similar to plum-stones, and in some of the broken ones the kernel was recognizable; 150 feet below the tree they came upon a cement similar to that generally found in alluvial gold-fields. On Goree Station, near Yanko, when sinking a well at a depth of 80 feet, they came upon an old river bed, containing sand and gravel, and upon moving a large stone, which let in the water, a frog jumped out; it had no mouth, and was in other respects peculiar. When put in water on the surface it lived for a week, and then died. Was it covered up there when the river-bed was entombed, or was it carried there by the water usually passing in that underground channel? In building the bridge over the river at Dubbo, trees had to be cut through 85 feet below the present bed of the river. There is a well on Booroora, 15 miles west of the Mooni River. It is 40 feet deep, sunk through 9 feet of impervious clay, 26 feet of hard cement, and 5 feet loose sand, and from this the water rises to within 10 feet of the surface, coming up from the bottom in a thick stream, into which an iron rod 14 feet long was pushed and no obstruction felt. So much sand comes up with the water that the well has to be cleaned out from time to time. It takes a steam-engine and a large-sized centrifugal pump 1½ day to get the water out preparatory to cleaning, and when it is empty another well into the same sand or gravel shows no less, so that it is evident that the sand hinders the flow of water, otherwise it would not be possible to empty it at all. It is remarkable that every time this well is cleaned out so that the water has free ingress, considerable quantities of rounded

charcoal in pieces about the size of a pea are brought up by the water. A somewhat similar well is found on Kallara, S.W. of Bourke; it is very much deeper, has abundance of water, which rises from the sandy drift to 26 feet above the surface, but the sand accumulates and chokes the well. Other wells in the same district find abundance of water in sandy drift. Again, west of Wilcannia a number of wells find water in a river drift a long distance from the river, and in all of them the water rises to the same heights, proving that the water is from a common supply. About 50 miles S.W. of Gunnedah, at Bomera head station, is a well only 6 feet deep; water is almost always level with the surface, and the supply practically inexhaustible, though the creek near it is frequently dry. On Garraville station is a well yielding 9,600 gallons per hour; near it the ground sounds quite hollow for 100 acres, and there are holes in it 3 or 4 feet deep, at the bottom of which you can see and hear the water rushing on in its subterranean course. On Cox's Creek many years ago a deep well about 80 feet was sunk to hard rock, and there was no sign of water, but as soon as they cut through the hard rock at the bottom, there came such a rush of water that they had to abandon their tools and get up the rope as fast as possible to save their lives; the water rose to within 10 feet of the surface. Years after, another well was made 80 yards from it, and next day the first well began to overflow, and has continued to do so ever since. In the valley of the Peel below Tamworth a large body of water passes down underneath the bed of the river in a gravel bed. The same sort of thing is seen in the river at Tenterfield. Ten miles south of the river at Condobolin a number of wells have been put down (about 50 feet) into what is by all considered a perfectly inexhaustible supply of good water, sufficient for irrigation and every requirement. These form just a sample of hundreds of cases that want arranging and explaining; for if there are old river beds in one part of the plains why not in another, and why may there not be an abundant drainage in such old watercourses? Mr. T. K. Abbott, who devoted so much time to an investigation of the wells on Liverpool Plains, told me that from a study of 200 wells he was able to trace an old river bed across the plain which had abundance of water in it. Mr. W. Abbott says in most parts of the Darling country there are to be seen depressions 2 or 3 feet in depth, and sometimes 4 or 5 yards in diameter, with one or more holes in the bottom through which the surface water finds its way to lower strata; these holes exhibit no tendency to fill up—they swallow all the water that comes. For days and days a stream of water has been seen going down these holes, and one naturally asks, where to? Compared with the area of the whole Colony we have only a well here and there, and if out of these a few run over with a supply practically unlimited, and if again

these wells here and there point unmistakably to an older river system, overlaid by the present surface, would it not be better to look for it, and arrange our theory to fit the facts, and not the facts to fit the theory? In other countries it has been found advantageous to do so, for Professor Marsh, of America, says:—"Hydrographical researches have demonstrated the existence of subterranean currents in many places where superficial geology had not suggested such a possibility. For example, the river Tiber, in Italy, loses suddenly a much larger proportion of the rainfall than can be accounted for by evaporation and the water flowing in the river; and Lombardine, than whom perhaps there can be no higher authority, satisfied himself that the quantity of water carried by these subterranean conduits and carried into the river is not less than three-fourths of the total delivery of the Tiber's basin. And we have reason to think it will be so here. To go no further than the Sydney water supply, what do we find? That rivers flowing through compact sandstone have yet running near them—that is, within two or three miles—springs which are little rivers in themselves. One such, found in the tunnel, is remarkable for the abundance of water which it furnishes. I will not detain you longer; but I think I have said enough to show that there is abundant room for investigation, and that a matter of such vital importance to the community ought to be taken up by a Royal Commission, or by some one with time and means at his disposal to carry out a complete investigation of the whole subject.

Additions to the Census of the Genera of Plants hitherto known as indigenous to Australia.

By Baron Ferd. von Mueller, K.C.M.G., M.D., Ph. D., F.R.S.

[*Read before the Royal Society of N.S.W., 5 December, 1883.*]

II.

Cissampelos, Linné, gen. plant., 368 (1737); after Stephania.
Pachygone, Miers in Annal. of nat. hist., second ser. VII, 37 (1851); after Stephania.
Ausemannia, F. v. M. in Wing's South. Science Rec. III., 127 (1883); after Pleogyne.
Fontainea, Heckel, these inaug. Montp. (1870); after Baloghia.
Adansonia, Linné, spec. plant 1190 (1753); after Camptostemon.
Malaisia, Blanco, fl. de Filipin. 789 (1837); after Antiaris.
Pseudomorus, Bureau in annal des sc. nat. sér. cinquième XI, 372 (1872); after Antiaris.
Hicksbeachia, F. v. M. in Wing's South Science Rec. III, 33 (1883); after Helicia.
Achnophora, F. v. M. in Transact. Roy. Soc. of S. Austr. (1883); after Brachycome.
Podosperma, Labillardière, Nov. Holl. pl. specim. II, 35, t. 177 (1806); instead of Podotheca.
Dimorphocoma, F. v. M. and Tate in Transact. Roy. Soc. of S. Austr. (1883); after Elachanthus.
Isandra, F. v. M. in Wing's South. Science Rec. III, 2 (1883); after Anthocercis.
Dicladanthera, F. v. M., fragm. phytogr. Austr. XII, 23 (1882); after Ruellia.
Strobilanthes, Blume Bijdr. 796 (1826); after Ruellia.
Oncinocalyx, F. v. M. in Wing's South. Science Rec. III, March (1883); after Spartothamnus.
Tatea, F. v. M. in Transact. Roy. Soc. of S. Austr. (1883); after Premna (or section of that genus).
Eria, Lindley, in Edw. Bot. Register t. 904 (1825); after Phreatia.
Luisia, Gaudichaud in Freyc. voy. Bot. 426, t. 37 (1826); after Sarcochilus.
Phormium, R. & G. Forster, charact. gen. 47, t. 24 (1776); after Rhipogonum.

Wilsoniella, C. Mueller in Uhlworm et Behrens Bot. Centralblatt VII, 345 (1881); after Orthodontium.

Ephebe, Fries, plant. homonem. 256 (1825); after Lichina.

Calicium, Persoon in Usteri's Annalen I, 20 (1797); after Sphaerophorus.

Lobaria, Hoffmann in Schreber, gen. II, 768 (1791); after Sticta.

Dichonema, Nees in Fries, plant. homon. 303 (1825); after Pannaria.

Amphiloma, Acharius, lichen. univers. 338 (1810); after Pannaria.

Arthropyrenia, Massalongo, Mem. lich. 165 (1853); after Pertusaria.

Porina, Acharius, lichen. univ. 60 et 308 (1810); after Pertusaria.

Clathroporina, J. Mueller in Regensb. Flora (1883); after Pertusaria.

Buellia, De Notaris in Giorn. bot. Ital. II, 195 (1851); after Lecidea.

Rhizocarpon, Ramond in De Candolle, Flore française II, 365 (1855); after Lecidea.

Mycoporum, G. F. W. Meyer, Entw. Flecht. 327 (1825); after Opegrapha.

Stigmatidium, G. F. W. Meyer, Entw. Flecht. 328 (1825); after Opegrapha.

Graphina, Chevallier in Journ. Phys. XCIV, 49 (1822); after Opegrapha.

Melanographa, J. Mueller in Regensb. Flora (1882); after Opegrapha.

Phaeographis, J. Mueller in Regensb. Flora (1882); after Graphis.

Normandina, Nylander in Regensb. Flora 381 (1858); after Endocarpon.

Amphoridium, Massalongo in Regensb. Flora 593 (1852); after Verrucaria.

Pseudopyrenula, J. Mueller in Regensb. Flora (1883); after Pyrenula.

Fistulina, Bulliard, hist. des champ de la France, 314 (1812); after Porotheleum.

Microcera, Desmazières in Ann. des scienc. nat. trois. série X, 359 (1848); after Clavaria.

Spumaria, Persoon in J. Fr. Gmelin syst. nat. 1466 (1791); after Diderma.

Rhizopogon, Fries, symbol. gasteromys. 5 (1818); after Hydnangium.

Sphaeropsis, Leveillé in Ann. sc. nat. trois. sér. III, 62 (1845); after Phoma.

Gloeosporium, Montagne in Ann. sc. nat. trois. sér. XII, 295 (1849); after Excipula.

Sporidesmium, Link in Berl. Mag. III, 41 (1801); after Torula.

Morchella, Dillenius nov. gen. 74 (1719); after Helvella.

Lecanidion, Endlicher, flor. Poson. 46 (1836) (Patellaria, Nees); after Peziza.

Urnula Fries, summ. veg. Scandin. II, 364 (1849); after Peziza.
Eurotium, Link in Berl. Mag. III, 31 (1809); after Sphaeria.
Callipsygma, J. Agardh in litteris (1883); after Horea.
Microthoe, Decaisne in Ann. des sc. nat. sec. sér. XVIII, 116 (1842); after Galaxaura.
Merrifieldia, J. Agardh in litteris (1883); after Hypnea.
Letterstedtia, Areschoug in Vet. Akad. Oefvers VII, 1 (1850); after Enteromorpha.
Graphiola, Poiteau in Ann. des sc. nat. III, 473 t. 26 (1824); after Trichodesmium.
Tryblionella, W. Smith, synops. of Brit. Diatom. I, t. XXX (1855); after Nitzschia.

Abstracts of Papers from other Journals.

On the Chemistry of Australian Products.

By W. A. Dixon, F.C.S.

(Up to 1882.)

Aleuritis triloba. Forst. and Cocoa-nuts, G. Mallino (Gazzetta chimica Italiana II, 257 ; Chem. Soc. J. XXVI, 85).

Candle-nuts.—The fruit of this tree, indigenous in the Pacific Islands, are so called from their easy inflammability. The fresh kernels are not unpleasant to the taste, but exert a purgative action, they are however eaten by the natives after roasting.

The average weight of the shells is 6·5 grm.—of the kernels, 3·3 grm.

Composition of the shells :—

Water	3·71
Organic matter	89·90
Ash	6·39
	100·00

Composition of the fresh kernel :—

Nitrogen 3·64 per cent.

Water	5·25
Fat	62·97
Cellulose, &c.	28·99
Ash	2·79
	100·00

The ash of the kernel contained

Lime	18·69	0·52
Magnesia	6·01	0·17
Potash	11·33	0·31
Phosphoric anhydride ..	29·30	0·82

The second column shows the percentage on the kernels.

The fatty matter extracted from the kernels by carbon disulphide at ordinary temperatures is a transparent amber yellow syrupy liquid. When cooled to — 10° it becomes viscous, but does not otherwise alter. It rapidly becomes rancid, and acquires a yellow brown colour and a disagreeable odour, and is used in Europe for soap-making.

Note by abstractor.—A very superior lamp-black is made from the oil by the S.S. Islanders, who use it mixed with the expressed oil to form the black patterns on their mats.

The same author has examined copra or dried cocoa-nuts, and the cake left after expressing the oil, the latter of which is used extensively as a cattle fodder in England, with the following results :—

	Cocoa-nuts.	Oil-cakes.
Water	5·80	11·89
Fat	67·85	12·34
Cellulose, &c.	24·80	69·66
Ash...	1·55	6·11
	100·00	100·00
Nitrogen per cent.		2·75
Phosphoric anhydride per cent. in ash ...		24·35

NUTS OF ALEURITES TRILOBA. B. Corenwinder. (Compt. Rend. LXXXI, 43.) The nut consists of 33 per cent. of kernel and 67 per cent. of endocarp. The kernel has the following composition :—

Water	5·000
Oil	62·175
Nitrogenous substance*	22·653
Non-nitrogenous ,, ...	6·827
Ash	3·345
	100·000
* Containing nitrogen	3·625

The ash of the kernel contained :—

Potash	17·25	Soluble in water.
Magnesia	0·65	Soluble in water.
Phosphoric oxide	14·32	Soluble in water.
Magnesia	14·47	Insoluble in water.
Lime	13·07	Insoluble in water.
Silica	4·64	Insoluble in water.
Phosphoric oxide	35·60	Insoluble in water.
	100·00	

The cake obtained from the nuts after decortication contained :—

Water	10·25
Oil	5·50
Nitrogenous substances*	47·81
Non-nitrogenous ,, ...	24·04
Phosphoric oxide	3·68
Potash	1·53
Magnesia, lime, silica, &c.	7·19
	100·00
* Containing nitrogen	7·65

Although from its purgative qualities the cake is not adapted for feeding, it forms a good manure. The expressed oil is also purgative, and its lighting power, even without refining, is superior to that of colza.

Oil of Aleurites triloba. M. E. Hakel. (Compt. Rend. Aug. 23, 1875, Ch. News. XXXII, 157.)

The oil is not much more purgative than oil of sweet almonds. It was used in New Caledonia for the lamps in a light-house; but it corroded the metal jets, even those of platinum. The author was unsuccessful in his endeavour to so purify it as to prevent this action.

Cocoa-nut oil cake. Gronven. (Wochen blatt der Annalen der Landwerthschaft, 1866, p. 453. Chem. Soc. J. XXVI, 87.) The following numbers were obtained :—

Proteïds	21·20
Fat	8·60
Cellulose	7·70
Water	9·36

and the ash contained in 100 parts—

H_2O	Na_2O	CaO	NyO	Fe_2O_3	P_2O_5	SO_3	SiO_2	C_2
40·57	2·30	4·71	2·95	3·54	26·98	3·78	3·38	13·42.

Alstonia constricta. Palm. (Jaresb. 1863, 615; Watt's Dict. Sup. I, 101.)

The bark of *Alstonia constricta* contains a neutral resinous bitter principle (similar to cailcedrin and tulucunin), a volatile oil smelling like camphor, an iron-greening tannin, gum, resin, fat, wax, protein substance, oxalic acid and citric acid. The ash, amounting to 6·06 per cent. on the bark, contains—

Nu_2O	K_2O	NuCl	CuO	NyO	Fe_2O_3	Nu_3O_4	So_3	P_2O_5	SiO_2	CO_2
0·48	6·96	3·06	32·83	3·61	3·43	0·78	9·33	Tr.	15·60	23·50

Alstonine. Von Mueller and Rummel. (C.S.J. XXXV, 31.)

The alkaloid from the bark of *Alstonia constricta* is obtained by treating its alcoholic extract with water and hydrochloric acid, precipitation by ammonia, and solution of the separated flocks in ether. The ether is evaporated, and a repetition of the process leaves the alkaloid as an orange-yellow, brittle, pellucid mass, which is very bitter. It melts below 100°, is carbonized at higher temperatures, is easily soluble in alcohol, ether, and dilute acids, sparingly in water, and all when dilute show a strong blue fluorescence. Its alcoholic solution is slightly alkaline, but although it combines with acids it does not completely neutralize them. Strong acids and alkalies decompose it partially on evaporation in the water bath, leaving a dark-coloured viscid acid substance. The hydrochloride gives precipitates with the chlorides of platinum and mercury, the potassio-mercuric and potassio-bismuthous iodides, also with biniodide of potassium, phospho-molybdate and phospho-tungstate of sodium, bichromate of potassium, picric acid, alkalies and alkaline carbonates. Tannin does not precipitate the hydrochloride, but precipitates the acetate or the free base. Concentrated nitric acid dissolves alstonine

with a crimson colour, becoming yellow on warming; sulphuric acid with reddish brown colour changing to dirty green; with hydrochloric acid it gives a yellow solution.

ALSTONIA BARK. O. Hesse. (Deut. Chem. Ges. Ber. XI, 2232; C.S.J. XXXVI, 332.)

The bark contains from 2 to 2·5 per cent. of chlorogenine and 0·1 per cent. of porphyrine. The author considers that Palm's alstonine (Wittstein's Viertel Jaresb. f. pr. Pharm., XII, 161) is a mixture of these two alkaloids, and that the alstonine of Mueller and Rummel is probably impure chlorogenine.

ALSTONIA CONSTRICTA. Oberlin and Schlagdenhauffen. (Pharm. J. Trans. [3]. X 1059. C.S.J. XXXVIII, 127.)

The bark extracted with ether, alcohol and water successively gives up 1·038, 27·74 and 1·371 per cent. of extract respectively. The orange-coloured residue left on evaporating the etherial solution taken up in dilute hydrochloric acid (1·200) treated with animal charcoal, precipitated with ammonia and redissolved in ether, (these operations being repeated until all colouring matter is removed) crystallizes in silky tufts of lustrous needles from the etherial solution. It is soluble in ether, alcohol, chloroform, benzine, acetone and light petroleum, moderately soluble in boiling water but insoluble in cold. It dissolves readily in dilute acids, and is precipitated by the same reagents as the other alkaloids. It is easily soluble in concentrated sulphuric, nitric, or hydrochloric acids, without colouration, but on diluting these solutions a blue fluorescence is produced. Concentrated sulphuric acid with bichromate of potasssium colour the crystals intensely blue-green, passing to violet and purple; on adding water a crimson solution is obtained.

The etherial mothers from which the alstonine had crystallized left an amorphous alkaloid on evaporation, which the authors propose to call *alstonicine.* It resembles alstonine, but is only sparingly soluble in boiling water. It dissolves in concentrated sulphuric and hydrochloric acids with a greenish brown tint, in nitric acid with a splendid crimson red, and its acid solutions do not exhibit fluorescence.

PORPHYRINE. O. Hesse. (Ann. Ch. Pharm. Suppl. IV, 40; Watt's Dict. Suppl. I, 955.)

A base obtained from an Australian bark (*Alstonia constricta?*) The aqueous extract of the bark is acidulated with sulphuric acid, and mixed with mercuric chloride, which forms a precipitate. The excess of mercury is removed from the filtered solution by sulphureted hydrogen, the liquid neutralized by ammonia, evaporated to a small bulk, the alkaloid precipitated by carbonate of sodium and extracted by ether. The etherial solution is decolourized by animal charcoal and evaporated, when the porphyrine

remains as a varnish, soluble in water and in alcohol, and partly crystallizing from the latter in thin, white prisms. Its solutions are alkaline and intensely bitter. The base melts at 82°, and resolidifies in the amorphous state. With strong nitric acid it exhibits a characteristic red colour; with sulphuric and hydrocloric acid it forms neutral salts, whose solutions exhibit a strong, blue fluorescence when slightly acidulated. The sulphate crystalizes in thin prisms, easily soluble in water and alcohol; the hydriodide, mercuro-chloride, platino-chloride, and auro-chloride are yellow or white precipitates. In the solution of the acid sulphate, potassium dichromate produces a blood red colour, which subsequently disappears, with formation of a yellow precipitate.

CHLOROGENINE. O. Hesse. (An. Ch. Pharm. Suppl. IV, 40. Jaresb. 1865, p. 458; Watt's Dict. Suppl. I, 443.)

The mercuric-chloride precipitate (last extract) is the mercuro-chloride of chlorogenine. Separated from the mercury compound and precipitated from the solution of its sulphate by ammonia, it is a coffee-coloured amorphous powder easily soluble in acids when recently precipitated, soluble also in ammonia, fusel oil, and especially so in chloroform, with which it yields a solution, red-brown by transmitted and green by reflected light. It is very bitter, and causes uneasiness and a tendency to vomit when swallowed. It is the active and colouring principle of the bark, which contains 2½ per cent. of it. Its formula is $C_{24}\ H_{20}\ O_4$, and it yields only amorphous salts.

ALKALOIDS OF ALSTONIA CONSTRICTA. O. Hesse. (Annalen CCV, 360, Chem. Soc. Jour. XL, 623.)

Various substances have been described by different chemists under the name of alstonine, which the author proposes to confine to chlorogenine.

This base is prepared by dissolving the alcoholic extract of the bark in water saturated with acid sodium carbonate. The clear filtered solution is agitated with light petroleum to remove other bodies, and the alstonine obtained by saturating the solution with soda and shaking with chloroform, which becomes blackish brown. The base is removed from the chloroform by agitation with water and acetic acid; the chloroform being distilled off, the acid liquid is purified by filtration through animal charcoal and the alkaloid precipitated by soda.

ALSTONINE, $C_{21}\ H_{20}\ N_2\ O_4$, is a brown amorphous mass, becomin darker in the desiccator and finally of a coffee colour, the change being rapid at 80°. It dissolves easily in chloroform but less so when dried, easily also in alcohol, but sparingly in ether. The dry alkaloid melts at 195° (uncorr.) whilst its hydrate (with 3½ H_2O) melts below 100°. Alstonine, contrary to the observations of Palm, is a strong base forming salts with acids. Its platino-

chloride has the composition $(C_{21} H_{20} N_2 O_4)_2 Pt Cl_6 H_2 + 4Aq$ The sulphate hydrochloride, tartarate, and oxalate are soluble in water, but excess of the acids precipitate the salts in brown flocks. An acid present in the bark acts in a similar manner, and forms a difficultly soluble alstonine compound, which the author considers was probably Palm's alstonine.

PORPHYRINE, $C_{21} H_{25} N_3 O_2$ is contained, with other substances, in the light petroleum solution, from which it is removed by agitation with acetic acid, to which it communicates a fine blue fluorescence. From the acetic acid solution it is precipitated by ammonia as a reddish white precipitate, which is dissolved in ether and treated with animal charcoal, which gives up a small quantity of alstonine as well as another base (porphyrosine) which can be removed from the charcoal by acetic acid, to which it gives a fine purple red colour; the etherial solution gives up the porphyrine to dilute acetic acid, from which it is precipitated by ammonia. So purified, porphyrine is a white, amorphous substance, melting at 97°, readily soluble in alcohol, ether, and chloroform. The alcoholic solution, largely diluted with water, shows a slight blue fluorescence. The alkaloid gives the following reactions:—With concentrated sulphuric acid, a purple solution; with sulphuric acid and chromic acid, a greenish blue colouration, which becomes yellowish green; concentrated nitric acid, a purple solution, becoming yellowish or brownish green. In acid solution it gives a blue fluorescence. It forms a platino-chloride $(C_{21} H_{25} N_5 O_2)_2 PtCl_6H_2$. Only 0·6 grm. porphyrine was obtained from 2 kilos of the bark.

ALSTONIDINE (composition unascertained) is separated from porphyrine by its less solubility in light petroleum. It is readily soluble in choroform, ether, alcohol, and acetone, and crystallizes from solution. The alcoholic or dilute acid solutions have an intense blue fluorescence. Ammonia and soda precipitate it from acid solution in flocks, which soon become crystalline. It forms various salts, which mostly crystallize easily. The base melts at 181°C. It resembles the alstonine of Oberlin and Schlagdenhauffen, but differs in its reactions with sulphuric acid and chromic anhydride, which turn the latter bluish-green, then violet, then purple-red.

The author considers he has not exhausted the number of alkaloids in the bark.

ATHEROSPERMA MOSCHATUM. N. Zeyer (Jaresb. 1861, 769. Watt's Dict. Sup. I, p 231.)

The bark of the Victorian sassafras contains ash amounting to 3·64% on the air dried, or 4·06 on the bark dried at 100°C.; it contains—

NaCl	K_2O	Na_2O	CaO	NyO	Al_2O_3	FeO_3	M_2O_3	SO_3	P_2O_5	SO_2	CO_2
2·675	4·033	8·321	45·445	4·361	0·191	0·098	0·477	1·443	1·186	1·396	30·005.

The bark contains a volatile oil, fixed oil, wax, albumen, gum, sugar, starch, butyric acid, oxalic acid, an aromatic resin, iron-greening tannin, and an alkaloid which the author names atherospermine. The lead compound of the tannin, obtained by precipitating the clear watery extract of the bark with acetate of lead, digesting the washed precipitate with acetic acid, and reprecipitation with ammonia, added to exact neutralization, gave numbers agreeing with the formula $C_{10}H_{14}$ PbO_3.

After removal of the tannin and substances soluble in water and in dilute sulphuric acid, treatment of the bark with dilute soda extracts the aromatic resin, which can be precipitated by dilute hydrochloric acid, and purified by treatment with alcohol and water. The resin is brownish red, has an aromatic odour, a taste of nutmeg and sassafras, melts at 114°, is easily soluble in alcohol, alkaline hydrates, and carbonates, but difficultly so in ether and turpentine; its composition is expressed by the formula $C_{23}H_{32}$ O_5.

The atherospermine is obtained by precipitating the filtrate from the tannin lead compound by ammonia. The precipitate, of which a further quantity is obtained from the dilute sulphuric acid extract, is washed and dried, digested with alcohol, the solution evaporated, the residue taken up by hydrochloric acid, again precipitated by ammonia, washed, dried, extracted with carbon bisulphide, the solvent evaporated, and the residue a third time taken up by hydrochloric acid and precipitated by ammonia. The atherospermine so obtained is a white or greyish light highly electric powder, having a pure bitter taste and without odour. Exposure to light turns it yellowish; it melts at 128°, and on further heating emits an empyreumatic odour, ignites, and burns away without leaving a residue. When slowly heated it first gives an odour of putrid meat and then of herrings. It is soluble in chloroform, turpentine, and volatile oils, and in alcohol, which solution has an alkaline reaction; is difficultly soluble in ether, and almost insoluble in water. It neutralizes acids, forming varnish-like salts, and liberates iodine from acqueous hydriodic acid. The neutral solution of the hydrochloride gives yellow precipitates with picric acid, tannin, phospho-molybdic acid, and platinic chloride, and white by alkalies and their carbonates. The composition of the alkaloid has not been determined.

Duboisia Myoporodes. A. Landenberg. (Compt. Rend. XC, 874.) See Journ. R.S., N.S.W., 1880, 125.

Duboisia Myoporoides. A. W. Gerrard. (Pharm. J. Trans. [3]. VIII, 789; C. S. J., XXXIV, 589.)

The bark is extracted with water, alcohol added as long as a precipitate is formed, the alcohol distilled of the residue diluted with water, made alkaline with ammonia and shaken with chloroform which dissolves the alkaloid. The chloroform is evaporated;

the residue dissolved in dilute sulphuric acid, and neutralized by ammonia, when oily drops separate from which the alkaloid is extracted by ether. Duboisine so obtained forms a yellow viscous mass, soluble in alcohol, ether, chloroform, benzine and carbon bisulphide, but only sparingly soluble in water, to which it gives an alkaline reaction. In its physiological action and in some chemical reactions it resembles atropine.

With tannic acid it gives a white precipitate soluble in hydrochloric acid; with Nessler solution a white precipitate, alkalies a white precipitate soluble in excess; with chloride of gold or platinum it gives yellow precipitates; with mercuric chloride it gives a precipitate in concentrated solutions. Strong nitric acid gives with it a slight brown colouration, whilst this re-agent gives no reaction with atropine. Atropine is not acted on by sulphuric acid in the cold, but on heating it evolves an aromatic odour which is increased by chromate of potassium, chromic oxide being precipitated. Duboisine on the other hand gives a reddish brown colour with sulphuric acid in the cold, and on heating, an odour of butyric acid, and does not reduce chromate of potassium. Boiled with baryta-water atropine gives an odour of oil of gaultheria or of hawthorn, whilst duboisine gives an odour of butyric acid. The alkaloid is more soluble in water than is atropine, and the sulphate and hydro-bromide are the only salts which crystallize. The physiological actions of duboisine resemble those of atropine, in that it dilates the pupil, causes dryness of the mouth, and thirst, prevents the action of muscarine on the heart, and after some time produces tetanus.

DUBOISINE. Baron F. von Mueller and L. Rummel (C.S.J. XXXV, 32.)

This volatile alkaloid obtained from the leaves and twigs of *Duboisia myoporoides* is probably identical with the piturine found by Staiger in *D. Hopwoodii*. It is prepared like nicotine, and is a yellowish oily liquid lighter than water, of a strong narcotic odour, resembling nicotine and cantharides, has a strong alkaline reaction, neutralizes acids completely; dissolves in any quantity of ether, alcohol and water, throws down ferrous oxide from ferrous sulphate, dissolves without colour in concentrated acids. Its dihydrochloride, which is deliquescent, when greatly diluted with water is precipitated by biniodide of potassium, potassio-mecuric and potassio-bismuthous iodide and by tannic acid, but not by any of the other alkaloid reagents.

Nicotine, which duboisine resembles, is distinguished from the latter by its specific gravity, less powerful odour, by its hydrochloride, and by being precipitable by phospho-molybdate of soda, picric acid and chloride of platinum.

Note by abstractor. It is evident that the name duboisine has been applied to two different substances, and it may be that one

exists in the bark the other in the twigs and leaves of the plant. The characteristic reactions of the alkaloid as given in the two papers are diametrically opposed to one another, and it is to be regretted that no analyses are given in either case. See Liversidge, Journal Royal Society of N.S.W., 1880.

EDIBLE CLAY from New Zealand, M. M. Pattison Muir (Chem. News, 36-202). The clay came from Simon's Pass Station, Mackenzie county, South Island, where it forms a range of low bare hills and is eaten by the sheep in considerable quantities, it is thought for the salt that it contains. It gave on analysis—

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	(NaK)Cl	Organic Matter	Water
61·25	17·97	5·72	1·91	0·87	3·69	1·77	7·31

ASH OF EUCALYPTUS. W. Smith. (Chem. Soc. Journ. XXXVII, 416.)

The ash of *E. rostrata* (red gum) and *E. globulus* (blue gum) were examined and found to contain—

	K_2O	Na_2O	MgO	CaO	Ferric and Aluminic Phosphates.	MnO	Al_2O_3	SiO_2	SO_3	Cl.	Sand and Carbon.	CO_2
E. rostrata ...	9·50	3·40	6·30	43·80	0·78	Tr.	—	0·29	1·57	0·60	1·77	31·28
E. globulus ..	25·00		6·47	35·08	1·07	Tr.	Tr.	0·34	1·55	0·85	1·04	29·33

The percentage of ash in the wood of the first was 2·25, and in the second 2·01.

LEAVES OF EUCALYPTUS GLOBULUS. E. Rabuteau (Compt. Rend. LXXV, 1431.)

An alcoholic extract of the leaves from which the resin has been precipitated by water, acidulated by hydrochloric acid, and the tannin by an iron salt, gives no precipitate with either iodine in solution of iodide of potassium, or with phospho-molybdic acid. The author therefore concludes that the leaves are free from any basic substance similar to the vegetable alkaloids.

CHLOROPHYLL OF E. GLOBULUS. Schunck. (Chem. News, XLII, 31.)

The leaves of *E. globulus* were examined to find whether their glaucous colour is due to any particular modification of chlorophyll. The peculiar colour was found to be due to a covering of fatty matter which may be dissolved off by ether, the leaves then becoming green. The ether leaves on evaporation a white semicrystalline fatty residue, which melts below 100°C. and is soluble in dilute boiling lye, so that it probably consists in part of some

fatty acid. The ether-washed leaves do not differ in colour from ordinary leaves, but the alcoholic and etherial extract of them shows a peculiarity in the chlorophyll in regard that the spectral absorption bands are rapidly changed, even in the dark, into those characteristic of acid chlorophyll. The solution which at first is without action on litmus at the same time becomes acid. In twenty-four hours the change is complete, whilst a solution of chlorophyll from grass is unaltered in seven days. The latter solution on insolation for a few hours almost completely loses its colour and becomes pale yellow, and then hardly shows a trace of absorption bands, the band I being only just discernible. The eucalyptus chlorophyll on the other hand, after being kept in the dark for twenty-four hours, on exposure to sunlight becomes much paler in colour, but the bands I, II, and IV are quite as distinct as before, whilst in addition to these the broad band IV, between the E. and F. lines, which also belongs to acid chlorophyll, comes out very clearly. The author is inclined to attribute the change to the essential oil of the leaves converting ordinary oxygen into ozone, which has been found by Gerlach to produce a similar effect in ordinary chlorophyll; but a comparative trial with leaves from an orange tree also containing essential oil showed that no change took place in the dark, though on insolation bands I and IVc. remained visible, whilst in extract of grass the former becomes faint and the latter disappeared.

LEAVES OF E. GLOBULUS. P. A. Hartzer. (Deut. Chem. Ges. Ber. IX, 314; Watt's Sup., III, 762.)

The old leaves exhausted with alcohol yield a complex resin consisting of tannin, a resinous acid dissolving with a crimson colour in sulphuric acid; a fatty acid melting at 245° to 247°, and containing 77 per cent. carbon, and 11 per cent. hydrogen; an alcohol which is perhaps ceryl alcohol, and several resins.

LERP MANNA. Flückiger. (Arch. Pharm. [2], CXLVI, 543; Watt's Dict. Supl. II, 733.)

This substance, found on the leaves of *Eucalyptus dumosa*, consists of white threads cemented by a syrup produced by the insect *Psylla eucalypti*, which spins them. It contains water 14 per cent., sugar 53 per cent., threads 33 per cent. The threads are starch-like in properties, but differ in form. When the substance is washed with water the sugar and a little of the threads dissolve, so that the solution is coloured blue by iodine. The remaining threads are slightly swollen, and consist of Lerp amylum, which is very slightly soluble in water, either cold or at 100°, but heated to 135° with 30 parts of water in sealed tubes it is dissolved to a thin liquid, which on cooling deposits the unchanged substance almost completely in flocks without forming a jelly. In the air bath at 190° it becomes brown, and then only reddens iodine solution, and

becomes partly soluble in hot water. By oxidation with nitric acid it yields oxalic acid and no mucic acid, and as it also gives no precipitate with lead acetate it is not a gum.

Analyses give 43·7 and 43·07 per cent. C, and 6·6 and 6·4 per cent. H, agreeing with the formula $C_6 H_{10} O_5$. Like starch, lerp amylum rotates the plane of polarization to the right; and on digestion with dilute sulphuric acid, forms a substance analogous to dextrin.

EUCALYPTUS MANNA. Johnston. (Mem. Chem. Soc. I, 159; Watt's Dict., II, 601.)

This manna is a loose white granular mass exuded by some of the Eucalypti and contains a crystallizable sugar melitose, which when air-dried has the formula $C_{12} H_{22} O_{11} H_2 O$.

MELITOSE. Berthelot. (Ann. Ch. Phys. [3], XLVI, 66. Chimie Organique. Par 1860 ii-260; Watts' Dict., III, 1869.)

This substance is extracted from Australian manna by water, and crystallizes in very thin needles, which are slightly sweet. The crystals are hydrated, and contain $C_{12} H_{22} O_{11}$ 3 $H_2 O$; they lose 2 at. water at 100, and the third at 130° C. They are freely soluble in boiling water and in nine parts of cold, and are also soluble in alcohol, and the latter solution yields small well developed crystals. The aqueous solution is dextrorotatory, and turns the plane of polarization for the transition tint $\alpha = +102°$.

Dilute sulphuric acid resolves it into a fermentable sugar and non-fermentable eucalyn

$$\underset{\text{melitose}}{C_{12} H_{22} O_{11}} + H_2 O = \underset{\text{glucose}}{C_6 H_{12} O_6} + \underset{\text{eucalyn}}{C_6 H_{12} O_6}$$

Melitose ferments with yeast, being first resolved into glucose and eucalyn, and hence only yields one half the alcohol and carbon dioxide that glucose does. It does not reduce alkaline cupric solutions, and is unaltered by boiling dilute alkalies or baryta water. Nitric acid oxidizes it, yielding mucic and oxalic acids.

EUCALYN. $C_6 H_{12} O_6$, produced by the fermentation of melitose, is syrupy, non-fermentable, and is not rendered so by the action of sulphuric acid. It is dextrorotary $\alpha = + 50$. At 100° C it becomes coloured, and at 200° is converted into a black insoluble substance. Sulphuric acid or strong hydrochloric acid destroys it at 100°, and boiling baryta water colours it strongly. It reduces Fehling's copper solution.

ESSENTIAL OILS. Gladstone. (Chem. Soc. Journ. XVII, 10.) Amongst other hydrocarbons of vegetable origin, Dr. Gladstone examined the oils of *E. amygdalina*, *E. oleosa*, and *Atherosperma moschatum* or Victorian sassafras. The first of these was found to consist principally of a hydrocarbon analogous to oil of turpentine and resembling it in odour. An analysis gave numbers agreeing

with the formula $C_{20} H_{16}$. The oil from *E. oleosa* contained as principal constituent an oil which resembles cajeput in physical proportion, but no analysis is given. The Victorian sassafras oil was of a pale yellow colour, and of a very peculiar odour; it began to boil at about 221°C, and passed over almost entirely at 224°C. This distillate is an oxidized oil, of specific gravity 1·0386 at 20° C. For the oil of *E. amygdalina* the following physical constants were determined:—Specific gravity at 20°C 0·8642. Boiling point 171°C. Refraction index at 20°C 1·4696. Dispersion at 20°C. ·0323· Specific refractive energy, ·5434. Rotation – 142. The refractive index being high, Dr. Gladstone thinks it possible that a little of some hydrocarbon of another type, but nearly the same composition, may be contained in it.

EUCALYPTOL. Cloez. (Ann. Ch. Pharm. CLIV, 372; Watt's Dict., Sup. II, 493.)

The crude oil from *E. globulus* contains a number of substances boiling between 188° C and 190° and above 200, but the eucalyptol is contained in that portion which distils between 170° and 178°. It is purified by being kept in contact first with potassium hydrate in the solid form, then with chloride of calcium, after which it is again distilled. The composition of eucalyptol is represented by the formula $C_{12} H_{20} O$; it boils at 175° C.; has a specific gravity of 0·905 @ 8°. It has a molecular rotatory power of + 10·42 for a length of 100 m. m. It is slightly soluble in water and completely so in alcohol, a dilute solution having an odour of roses. The vapour density observed is 5·92, the calculated being 6·22. Eucalyptol is slowly acted on by common nitric acid, with the fomation of various products, amongst which is an acid probably similar to camphoric acid. It blackens with concentrated sulphuric acid, and addition of water separates a tarry body which yields a volatile hydrocarbon on distillation. Heated with phosphoric oxide it gives up water, and yields eucalyptene $C_{12} H_{18}$ which boils at 165°, has a specific gravity of 0·836 @ 12°, and a vapour density of 5·3. At the same time another liquid eucalyptolene is produced, which boils above 300°, but has the same composition. Eucalyptol absorbs dry hydrochloric acid gas in large quantities, yielding at first a crystalline mass which afterwards however separates into water and an oil which appears to be the same as eucalyptene.

EUCALYPTOL. Faust a. Homeyer (Deut. Chem. Ges. Ber. VII, 63-14-29; C. S. J. XXVII, 475. Watt's Dict. Sup. III, 761.) These investigators find in the oil of *E. globulus* a terpene boiling at 150° to 151°, which is only found in small quantity, and which ignites in contact with iodine and is converted into a resin on exposure to the air. At 172-175 cymene, a camphor-like body having the composition $C_{10} H_{16} O$, and another terpene called

eucalyptene distil over together. The oil called eucalyptol by Cloez, the authors say is a mixture of about 70 per cent. of eucalyptene, and 30 per cent. of cymene, which boils between 171° and 174° after being rectified over sodium. The eucalyptene and cymene cannot be separated by fractional distillation, but the cymene is obtained by shaking the eucalyptol with sulphuric acid diluted with four parts of water, which polymerises the eucalyptene on standing, when the mixture diluted with water and distilled yields cymene, which after rectification over sodium boils at 173°-174° The eucalyptol dissolves in all proportions in absolute alcohol, ether, and chloroform, and in fifteen parts of 90% alcohol. It detonates with iodine and absorbs oxygen rapidly. Dilute nitric acid oxidizes it readily, forming paratoluic and terephthalic acids, whilst with strong sulphuric acid it becomes brown. The camphor-like body is a colourless oily liquid, which on exposure to light becomes yellowish; it boils between 216° and 218°. The analysis of this substance gives numbers between those required for the formulæ $C_{10} H_{14} O$ and $C_{10} H_{16} O$, but the reactions obtained show it is not an oxycymene, though by treatment with phosphorous sulphide it yields cymene.

ESSENTIAL OIL OF EUCALYPTUS. I. Homeyer. (Arch. Pharm. [3] V, 293, C. S. J., XIV, 244.) This paper is almost identical with the last abstract.

EUCALYPTUS OIL, probably from *E. odorata* or *E. amygdalina* Oppenheim and Pfaff. (Deut. Chem. Ges. Ber. VII, 625; Watts' 3° Sup. 761.)

The oil, by repeated treatment with potash, washing with water, and fractional distillation, gave eucalyptene boiling at 172° to 175°. The hydrocarbon did not form a crystalline compound with hydrochloric acid, nor a crystalline hydrate when left for six months in contact with nitric acid and alcohol. Treated with half the calculated quantity of iodine it is converted into cymene which treated with dilute nitric acid is oxidized to paratoluic acid melting at 173° to 175°. The crude oil contained no oxidized compound answering to the eucalyptol of Cloez.

THE RESIN OF E. GLOBULUS. F. A. de Hartzen. (Compt. Rend. LXXX, 1248.)

This resin was obtained as a residue, on distilling the alcoholic tincture of the leaves. It was found to contain tannin and several fatty substances. If the resin is dissolved in absolute alcohol, acetate of lead and a quantity of ammonia just sufficient to make the solution neutral, the tannin is precipitated, whilst the other substances remain in solution. The excess of lead being removed by sulphuretted hydrogen and the alcohol by distillation, a granular body remains, which contains a little wax which is soluble in alcohol, ether, benzine and concentrated sulphuric acid, but not in acetic

acid. On diluting the sulphuric acid solution a beautiful carmine colour is produced, and ether, added cautiously to this solution, causes the formation of a precipitate, whilst the fluid becomes purple; addition of water then separates the colouring matter as a brown precipitate which leaves the solution colourless. On neutralizing the sulphuric acid solution by carbonate of calcium a brown precipitate is obtained, which redissolves in sulphuric acid with a purple colour.

EUGENIA AUSTRALIS. De Luca a Ubaldini (J. Pharm. [4] III, 44, Watt's Dict. Sup. I, 608.)

The red juice of the fruit of the Australian myrtle is similar in its properties to that of red grapes. It contains free tartaric acid, cream of tartar, sugar, and a red colouring matter very sensitive to the action of acids and alkalies. By fermentation it yields a wine possessing a bouquet. The colouring matter, which is soluble in alcohol, or alcohol ether, but not in pure ether, is precipitated by lead acetate, decolourized by reducing agents, and recovers its red colour on exposure to the air, like litmus and the red colouring matter of wine.

INOCARPIN. Cuzent. (J. Pharm. XXXV, 241; Watt's Dict. III, 274.)

The juice of *Inocarpis edulis*, a tree growing in Tahiti, yields this red colouring matter. The juice which exudes from incisions in the bark of young trees, or the pericarp of green fruits is colourless; but soon turns red in exposure to the air, and dries up to a red gummy mass, soluble in water and alcohol, but insoluble in either. The juice of old trees is red as soon as it runs out. The aqueous solution mixed with caustic alkalies exhibits a play of colours when shaken up with air. The reddened juice contains also a yellow colouring matter called xanthocarpin.

KAURI GUM. M.M. Pattison Muir. (J. Chem. Soc. XXVII, 733.)

This resin, the product of *Damara Australis*, has a specific gravity of 1·042. It is partly dissolved in powder by water, and about 52 per cent. is soluble in boiling alcohol, whilst the residue is almost entirely soluble in cold ether. The alcoholic solution is slightly acid, and contains traces of benzoic and succinic acids. The following reactions were observed:—

1. Strong nitric acid attacks the resin violently on gentle warming, forming a yellowish white solid, but slightly soluble in alcohol or ether, and a red liquid giving a yellow flocculent precipitate with water.
2. Sulphuric acid dissolves the gum to a clear red liquid, in which water forms a white precipitate, but if the sulphuric acid solution is heated, it becomes dark-coloured and is no longer precipitated.

3. Chlorine and bromine attack the gum violently, forming a blackish substance soluble in alcohol with the latter, with the former carbon only remains.
4. Caustic alkalies boiled with the gum forms a light yellow hard mass.

Subjected to dry distillation it yields a brown heavy oil having a green fluorescence, mixed with water, and a dark red solid is left behind, which solidifies on cooling. Less than half the dried oil distilled below 320°, and the greater portion of this distilled between 155° and 165°. This portion was nearly colourless, immiscible with water, soluble in alcohol, had at 20° a specific gravity of ·854, and on combustion gave numbers approximating to the formula $C_{10} H_{20} O_7$. Hydrochloric acid changes it to a dark greenish brown liquid.

KAURI GUM. R. D. Thomson. (Ann. Ch. Phys. [3] IX, 499. Watt's Dict. II, 301.)

This resin consists of an acid resin, dammaric acid, and a neutral resin, dammaran, the first being soluble in alcohol. By spontaneous evaporation of an alkaline solution, the acid resin is deposited in crystalline grains containing 72·64 per cent. C, 9·31 per cent. H, and 18 per cent. O. A boiling alcoholic solution gives a precipitate with alcoholic ammoniacal silver nitrate, which contains 14·6 to 14·75 per cent. of oxide of silver. The author represents the resin as $C_{40} H_{31} O_7$, and the silver compound as $C_{40} H_{30} Ag O_7$.

The neutral resin insoluble in ordinary alcohol dissolves to a colourless varnish in abolute alcohol or oil of turpentine. It gave on analysis 75·02 per cent. C, and 9·6 per cent. H, and the autho gives its formula as $C_{40} H_{31} O_6$. It absorbs oxygen on long-continued heating. Distilled alone gently the resin yields dammarol, an amber-coloured volatile oil containing 82·22 per cent. C. and 11·1 per cent. H. Distilled with lime it yields a different yellow oil, called dammarone.

KURAKINE. W. Skey. (Chem. News, XXVII, 191.)

The nut of the kuraka tree (*Corynocarpus lævigata*) of New Zealand, although intensely bitter and poisonous, is used for food by the Maoris, after undergoing a preliminary treatment by roasting and washing.

The bitter principle, which is poisonous, is obtained by washing the ground nuts in water, the solution acidulated with acetic acid to precipitate casein, &c., and the clear liquid shaken with animal charcoal, which extracts the bitter principle, and again yields it to alcohol, from which it crystallizes by spontaneous evaporation in acicular crystals. The crystals are white with a pearly lustre, intensely bitter, feebly acid. At 212° F. they melt. With sulphuric acid give a dark rose colouration. The substance is soluble in water, alcohol, hydrochloric and acetic acid, ammonia, and potash ;

insoluble in ether and chloroform. It does not give precipitates with tannic acid, potassio-iodide of mercury, or potassio-sulphocyanide of zinc, and does not contain nitrogen. The substance is not an alkaloid, and as it reduces copper in presence of potash the author is of opinion it is a glucoside, and proposes for it the name karakine. Its composition is not given.

PETALOSTIGMA QUADRILOCULARE. Falco. (Chem. Centi, 1867, p. 142. Watt's Dict. Sup. I, 904.)

The stem bark of this euphorbiaceous plant contains besides the ordinary plant constituents a camphoroidal essential oil, and an indifferent bitter principle belonging to the glucosides. The bark contains 8·3 per cent. of ash, which contains—

$NaCl$	K_2O	Na_2O	CaO	MgO	Al_2O_3	Fe_2O_3	Mn_3O_4	SO_3	P_2O_5	SiO_2	CO_2
2·94	2·75	0·94	46·23	1·43	0·05	0·18	0·46	1·32	0 56	2·21	40·33

SYCORETIN. Warren de la Rue and Hugo Müller. (Chem. Soc. J. XV, 62.)

Ficus rubiginosa yields a resinous exudation like euphorbium, varying from white to red in colour; the smaller pieces are brittle, but it is sometimes tough in the interior of large pieces. It softens and becomes plastic at 30° C., and is not sticky if moistened with water. On heating it smells like wax, although inodorous in its natural state. It is insoluble in water, but gives a characteristic taste when chewed. Treatment of the resin with cold alcohol dissolves about 73 per cent. of sycoretin, whilst the residue treated with boiling alcohol yields about 14 per cent. of sycocerylic acetate, the insoluble matter amounting to 13 per cent. consisting of caoutchouc and impurities.

The sycoretin is obtained from the brown solution in cold alcohol by precipitation with water, repeated solution in alcohol and precipitation by water rendering it at length colourless. The best method is to allow a cold saturated solution to stand in the cold, when it gradually deposits a crystalline substance, and by then partly precipitating tho alcoholic solution by water a first precipitate is obtained, containing 74·65 per cent. C., and 10·11 per cent. H., whilst the second half contains 77·89 per cent. C., and 9·94 per cent. H.

Sycoretin is an amorphous, brittle body, white in colour, and neutral to test-papers; it is brittle and highly electric. It melts below 100°, and, when heated with water to the boiling point it floats on the surface as a thick liquid. It dissolves easily in alcohol, ether, chloroform, and turpentine, and is not precipitated from its alcoholic solution by neutral lead acetate, nor by cupric acetate. It is insoluble in water, dilute acids, ammonia, or alkalies. It dissolves in sulphuric acid or concentrated caustic potash with a fine green colour, without forming sugar, and on dilution with water a less soluble substance is precipitated. A few degrees

above its melting point it decomposes, frothing up and evolving water; on further heating it melts quietly and gives a distillate containing acetic acid and tar, and leaves a residue of charcoal. Nitric acid attacks it, and on warming dissolves it, forming a little oxalic acid, but no picric acid, though water precipitates from the yellow solution an acid nitro compound which forms an explosive compound with potash.

The solution in hot alcohol, obtained after treating the resin with cold alcohol, deposits sycocerylic acetate in crystals, which at the last are mixed with a little of some flocculent substance. By allowing the solution to cool to 40°, and then pouring off the liquid and re-crystallizing the solid obtained, from boiling alcohol, treating the crystals at 30° with ether in insufficient quantity for complete solution, the acetate is obtained pure whilst a neutral crystalline substance remains behind. The substance crystallized from alcohol is in the form of firm laminæ, resembling cholestrin, and from ether in flat six-sided tables. Its composition is represented by the formula $C_{20} H_{32} O_2, = C_2 H_3 (C_{18} H_{29}) O_2$. It melts at 118° to 120° and solidifies at 80° to a transparent mass, which becomes opaque and crystalline on standing. At a higher temperature it distils unchanged, but if rapidly heated the distillate smells of acetic acid and is somewhat rancid. It is brittle and strongly electric when rubbed, is easily soluble in hot alcohol, acetic acid, acetone, chloriform, ether, benzine, and turpentine, and is not precipitated from its alcoholic solution by neutral lead acetate or cupric acetate.

Sycoceryl acetate is converted by dilute nitric acid into a resin, whilst it easily dissolves in the concentrated acid, and is precipitated from this solution in yellow flocks. Sulphuric acid dissolves it and the solution becomes brown on standing, and on diluting the solution, a hard substance, soluble in chloroform and benzine but difficultly soluble in alcohol, and which fuses below 100°, is precipitated. It forms with chlorine, bromine, and iodine, resinous compounds, but if the last two are added to a warm alcoholic solution, crystals of a colourless bromine or iodine compound are deposited. Melted caustic potash decomposes it with evolution of hydrogen, but it is not affected by boiling potash solution. Sodium alcohol decomposes it, forming acetate of sodium and sycocerylic alcohol.

Sycocerylic alcohol $C_{18} H_{30} O$, is homologous with benzylic alcohol $C_7 H_8 O$, and cymylic alcohol $C_{10} H_{14} O$, is purified by precipitation from the sodium alcohol solution by water and re-crystallization from alcohol. It then forms thin crystals resembling caffeine, but usually aggregated in masses. It melts at 90° to a liquid which is heavier than water, and which re-solidifies to a crystalline mass on cooling, but if strongly heated it re-solidifies to a transparent glass, which only becomes crystalline by contact with alcohol. It

distils in part without decomposition, is insoluble in water, ammonia, or alkalies. It is readily soluble in ordinary alcohol, a dilute solution depositing a jelly on cooling, which afterwards becomes crystalline, whilst a concentrated solution gives a semi-solid crystalline mass on cooling. It is also soluble in ether, benzine, chloroform, and light petroleum. Sycoceryl alcohol is slowly attacked by boiling dilute nitric acid, a yellow resin being formed which, dissolved in warm alcohol gives both white and yellow crystals, and probably consists of a mixture of sycoceryl acid $C_{18} H_{28} O_2$, and nitro-cerocylic acid ($C_{18} H_{27} NO_2 O_2$?). The alcohol yields no acid by boiling with dilute chromic acid, but on one occasion thin neutral prisms, probably sycocerylic aldehide, $C_{18} H_{28} O$, were obtained. The alcohol dissolves in sulphuric acid without forming a conjugated compound, a viscid resin being thrown down by water from the brown solution. Pentachloride of phosphorus acting at 60°C. on a solution of the alcohol in benzine, evolves hydrochloric acid. After the evolution of gas ceases and the excess of phosphorus chloride is removed, water and aqueous alkalies extract from the benzine an amorphous, greenish, viscid substance which is obtained on evaporating the aqueous solution. It is easily soluble in ether and chloroform, but difficultly soluble in alcohol.

Potassium heated with sycoceryl alcohol becomes covered with a white crust with evolution of hydrogen, which on further heating blackens and ignites. With melted potash it evolves hydrogen, but does not form sycocerylic acid. With chloride of acetyl and benzoyl it forms the acetate and benzoate of cycoceryl respectively.

XANTHORRHEA HASTILIS. Stenhouse. (An. Ch. Pharm. LVII, 84. Watt s Dict. I, 2.)

The yellow resin from the grass-tree is soluble in alcohol, ether, or caustic potash. Its potash solution treated with hydrochloric acid deposits benzoic and cinnamic acids. Nitric acid converts it very readily into picric acid. By distillation the resin yields a light neutral oil, which appears to be a mixture of benzine and cinnamene, and a heavy oil, consisting of phenol mixed with small quantities of benzoic and cinnamic acids.

PROCEEDINGS.

PROCEEDINGS

OF THE

ROYAL SOCIETY OF NEW SOUTH WALES.

WEDNESDAY, 2 MAY, 1883.

ANNUAL GENERAL MEETING.

CHR. ROLLESTON, C.M.G., President, in the Chair.

The minutes of the meeting held on December 6th, 1882, were read and confirmed.

The Annual Report of the Council was then read as follows:—

"The Council has the pleasure to report that the affairs of the Society continue in a satisfactory condition. The number of new members elected during the year was forty-one. The Society lost by death seven members, by resignation six, and fourteen were struck off the roll for non-payment of the annual subscription; the election of three new members was cancelled on account of non-payment of the entrance fee and subscription; thus leaving the actual increase eleven, and the total number of members on the 30th April, 1883, 486. During the past year the Society has received 791 volumes and pamphlets as donations; in return it has presented 835 volumes to various kindred Societies, as shown by the accompanying list. The Council has subscribed to forty-three scientific journals and publications, and has purchased 573 volumes, amongst the most important of which are the following complete series from the commencement to the present date:—Agricultural Journal, British Association Reports, Bulletin de la Société Géologique de France, Chemical News, Geological Society's Journal, Geological Magazine, Proceedings of the Geologists' Association, Meteorological Society—Proceedings and Journal, Royal Geographical Society—Proceedings, Royal Institution of Great Britain—Journal and Proceedings, Royal Irish Academy—Transactions,

Royal Society, London—Proceedings, and the Zoologist, at a cost of £336, which, together with new bookcases, account for bookbinding, &c., makes the total sum expended upon the library during the past year £422 12s. 10d. The Council reports that during the past year no reduction has been made in the mortgage upon the building (£1,500), but that the sum of £94 2s. has been received, and £271 7s. conditionally promised towards the Building Fund, in response to the circular sent out in August last. The amount now standing to the credit of this fund in the Bank is £189 13s. 11d. The Council again expresses a hope that during the ensuing season the members will make an effort to greatly lessen, if not entirely clear off, the debt upon the Society's premises. The Society's Journal, volume XV, for 1881, has been duly distributed to all the members entitled to it. During the year the Society has held ten meetings, including two adjourned meetings, at which twelve papers were read, and the Medical and Microscopical Sections have held regular monthly meetings. At the Council meeting held 13th December, 1882, it was unanimously resolved to award the Clarke Medal for the year 1883 to Baron Ferdinand von Mueller, K.C.M.G., F.R.S., &c., Government Botanist, Melbourne. At the same meeting the Council awarded the prize of £25 which had been offered for the best communication on the "Influence of Australian Climates and Pastures upon the Growth of Wool," to Dr. Ross, M.L.A., Molong, and the prize for the one upon "The Aborigines of New South Wales" to Mr. John Fraser, B.A., West Maitland.

The following Financial Statement for the year ending 30th April, 1883, was presented by the Honorary Treasurer :—

GENERAL ACCOUNT.

RECEIPTS.

	£ s. d.	£ s. d.
To Balance in Union Bank, 30th April, 1882		60 12 5
Subscriptions from 1st May, 1882, to 30th April, 1883...	556 15 6	
Entrance Fees, from 1st May, 1882, to 30th April, 1883...	84 0 0	
		640 15 6
Parliamentary Grant on Subscriptions and Entrance Fees, from 1st January to 31st December, 1882—Half the amount of £646 16s.		323 7 10
,, Sale of Society's Journal		4 3 6
		£1,028 19 3

EXPENDITURE.	£	s.	d.	£	s.	d.
By Advertisements	26	19	0			
,, Act of Incorporation (costs)	44	1	3			
,, Assistant Secretary—12 months' salary to 30th April, 1883	133	6	8			
,, Books and periodicals	331	3	5			
,, Busts of eminent Men of Science	4	16	10			
,, Bookbinding	28	10	6			
,, Covering and packing Exchanges and Presentations to Foreign Societies	4	2	6			
,, Delivering Society's Journal to Members ...	4	15	6			
,, Illustrations for Society's Journal	15	0	0			
,, Freight, carriage, packing-cases, &c. ...	26	18	11			
,, Furniture and effects	113	6	0			
,, Gas account	16	2	5			
,, Housekeeper, to 30th April, 1883	10	0	0			
,, Refreshments—general meetings	11	14	6			
,, Interest on mortgage, £1,500	77	11	7			
,, Insurance on building (for £4,000)	5	0	0			
,, ,, books and furniture (for £2,500)	2	19	11			
,, Postage	33	2	6			
,, Petty cash	11	17	6			
,, Printing	33	15	0			
,, Prize Essay Awards (2)...	50	0	0			
,, Rates, City and Water...	18	2	6			
,, Repairs to premises	3	11	7			
,, Stationery	2	12	6			
,, Sundry disbursements	12	1	6			
				1,021	12	1
,, Balance in Union Bank, 30th April, 1883				7	7	2
				£1,028	19	3

H. G. A. WRIGHT, Honorary Treasurer.
W. H. WEBB, Assistant Secretary.

Audited,—
J. TREVOR JONES.
F. POOLMAN.
Sydney, 27th April, 1883.

BUILDING FUND ACCOUNT.

RECEIPTS.	£	s.	d.
To Balance in Union Bank, 30th April, 1882	35	12	3
,, Subscriptions to Building Fund	94	2	0
,, Parliamentary Grant on Subscriptions received from 1st January to 31st December, 1882—£40 19s.	20	9	4
,, Rent of Rooms from sundry Societies	36	15	0
,, Sale of old Microscopic Slide Cabinet, &c.	2	15	4
	£189	13	11

EXPENDITURE.	£	s.	d.
By Balance in Union Bank, 30th April, 1883	189	13	11
	£189	13	11

H. G. A. WRIGHT, Honorary Treasurer.
W. H. WEBB, Assistant Secretary.

Audited,—
J. TREVOR JONES.
F. POOLMAN.
Sydney, 27th April, 1883.

STATEMENT OF ASSETS AND LIABILITIES ON THE 30TH APRIL, 1883.

Assets.	£	s.	d.
To Balance in Union Bank to credit of General Account ...	7	7	2
,, Subscriptions due	79	16	0
,, Rent of Hall, Senate of the University—12 months due 1st May, 1883	20	0	0
,, Books and furniture, valued at	2,500	0	0
,, Premises in Elizabeth-street—cost of purchase	3,525	0	0
,, Balance in Union Bank to credit of Building Fund Account	189	13	11
	£6,321	17	1

Liabilities.	£	s.	d.
By Savings' Bank of New South Wales—Loan on Mortgage...	1,500	0	0
,, Balance of Assets over Liabilities	4,821	17	1
	£6,321	17	1

H. G. A. WRIGHT, Honorary Treasurer.
W. H. WEBB, Assistant Secretary.

Audited,—
J. Trevor Jones.
F. Poolman.

Sydney, 27th April, 1883.

CLARKE MEMORIAL FUND ACCOUNT.

1882.	£	s.	d.
March 29—To Account at Fixed Deposit in Oriental Bank Corporation (Balance 29th March, 1882, £218 2s. 3d., Interest 12 months at 4 per cent., £8 14s. 4d.) ...	226	16	7

H. G. A. WRIGHT, Honorary Treasurer.
W. H. WEBB, Assistant Secretary.

Audited—
J. Trevor Jones.
F. Poolman.

Sydney, 27th April, 1883.

The statement was adopted.

Messrs. F. Poolman and P. N. Trebeck were elected Scrutineers for the election of officers and members of Council.

A ballot was then taken, and the following gentlemen were duly elected officers and members of Council for the current year:—

HONORARY PRESIDENT:

HIS EXCELLENCY THE RIGHT HON. LORD AUGUSTUS LOFTUS, G.C.B., &c., &c., &c.

PRESIDENT:

HON. J. SMITH, C.M.G., M.D., M.L.C.

VICE-PRESIDENTS:

CHARLES MOORE, F.L.S.
W. A. DIXON, F.C.S.

HON. TREASURER:

H. G. A. WRIGHT, M.R.C.S.E.

HON. SECRETARIES:

PROFESSOR LIVERSIDGE, F.R.S.
DR. LEIBIUS, M.A., F.C.S.

COUNCIL:

H. C. RUSSELL, B.A., F.R.A.S.	CHR. ROLLESTON, C.M.G.
ROBERT HUNT, F.G.S.	DR. W. MORRIS.
F. POOLMAN.	P. R. PEDLEY.

The following gentlemen were duly elected ordinary members of the Society:—

Kater, H. E., Moss Vale.
Lingen, J. T., M.A. (Cantab.), Sydney.
Osborne, Ben. M., J.P., Berrima.
Stephen, Cecil B., M.A., Sydney.

The certificates of two new candidates were read for the second time, and of ten for the first time.

The following gentleman was duly elected a corresponding member of the Society:—

Feistmantel Ottokar, M.D., Geological Survey, Calcutta.

The Chairman stated that the Council recommended that M. Louis Pasteur, M.D., of Paris, be elected an honorary member of the Society.

The election was carried unanimously.

Three hundred and sixty donations were laid upon the table.

The names of the Committee-men of the different Sections of the Society were announced, viz.:—

Microscopical Section.—Chairman: G. D. Hirst. Secretary: F. B. Kyngdon. Committee: Dr. Morris, H. G. A. Wright, M.R.C.S.E., P. R. Pedley, and H. O. Walker.

Medical Section.—Chairman: Dr. F. Norton Manning. Secretaries: Dr. H. N. MacLaurin, M.A., Thomas Evans, M.R.C.S.E. Committee: Dr. Mackellar, W. J. G. Bedford, M.R.C.S.E., Dr. Craig Dixson, Dr. Ewan, Dr. Schuette, and Dr. Hurst.

The following letter was read from Baron Ferdinand von Mueller, K.C.M.G., M.D., Ph. D., F.R.S., &c., &c.

Dear Professor, Melbourne, Christmas, 1882.

It is to me a source of infinite delight that the Council of the Royal Society of New South Wales in so generous a spirit has bestowed on me the Clarke Memorial Medal for 1883, a distinction which I prize beyond expressions in words adequate of my profound gratitude. Reflecting that the eldest scientific Society of Australia has selected me amongst the very first on whom this token of scientific encouragement has been bestowed, I may well be proud to be thus early enrolled on a list which, in the course of generations, is sure to contain a long series of illustrious names, with which those of the first recipients of this honor will be brought historically into contact within the realm of science.

For myself, I treasure the Clarke Medal all the more, as for more than a quarter of a century I had the privilege of scientific intercourse with its renowned Vice-president, who, while he left an enduring fame by his own great geological researches in this part of the globe, was ever eager to promote the work of younger investigators entering successively the field of knowledge.

The features of the reverend and venerable sage on the medal call vividly to my mind the several moments when I met him in life, and render this medal a special *souvenir*. May I trust that the opportunity will arise to show in some tangible manner my gratefulness to the learned Society which honoured me so highly in preference to others who had higher claims on this treasurable and lasting distinction.

Let me remain, honoured Sir,

Regardfully yours,

FERD. VON MUELLER.

To Professor Archibald Liversidge, F.R.S., F.C.S.,
Honorary Secretary of the Royal Society of N. S. Wales.

Mr. Christopher Rolleston, C.M.G., President, then read his address.

In moving a vote of thanks to the retiring President, Mr. Philip G. King made the following remarks respecting Mr. Darwin :—

It may be deemed excusable in one who was the young friend and associate of the celebrated man upon whose life, abilities, works, and theories our President has this evening delivered so able an address; I therefore crave the attention of the meeting for a few moments to say I have taken the deepest interest in what the President has brought before you. As a young man I had the honour of serving the Royal Navy under Admiral Fitzroy, whose portrait and autograph are before you; and whilst so serving I was the cabin mate of the great man who has recently passed away, and of whose memory I cherish the very highest regard. When I had the honour of knowing Mr. Darwin we were both young men, though he was my senior by several years; and I cannot call to mind that any of those theories which subsequently were enunciated by him had any existence in his mind further than such as he might have inherited from his grandfather, the great Dr. Darwin, whose prophetic poetry in allusion to the future greatness of this country is familiar to all :—

" Where Sydney Cove her lucid bosom swells,
Courts her young navies, and the storm repels," &c.

How amply his predictions have been fulfilled it is hardly necessary to point to the city we live in or to the scientific assemblage here to-night. If there is any one here to-night who has had the honour of early association with a

man who subsequently made his mark in the world, he will understand my feelings on hearing so lucid an address on the labours of my old companion. With Mr. Darwin I have ranged amongst the orange groves of Bahia and Botafogo; I have explored the coral rocks of the Abrolhos and the South Pacific; I have been tossed and tumbled about on the fearful tempestuous seas off Cape Horn—have trod the glaciers in the Straits of Magellan—have ridden amongst the wild Patagonians, and fished in his company with the lowest order of created man, the wretched inhabitants of Terra del Fuego. In company with Mr. Darwin I have shot the deer, the cavy, and the ostrich on the plains of the Pampas, witnessing the wonderful skill of the Guachos in the use of the bolas and the lasso. Every remembrance of my intercourse with that wonderful man burns like a lighted lamp. When first Mr. Darwin broached his theories, I felt impelled to acknowledge the force of his intercourse upon me. I am proud to think that I have lived to see his great name reverenced by the highest men both in Church and State in England. Men of the foremost social rank attended his funeral in Westminster Abbey, and two Archbishops of the Church of England headed a subscription list to raise a memorial to his memory. I beg, in conclusion, to move a vote of thanks to the President for his most excellent address.

About eighty members were present.

WEDNESDAY, 6 JUNE, 1883.

CHARLES MOORE, F.L.S., V.-P., in the Chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society:—

Amphlett, Edward A., R.N., Sydney.

Oram, Dr. Arthur Murray, Sydney.

In answer to Mr. C. Stuart, the Chairman stated that the Council had examined the papers sent in "On the Influence of Australian Climate and Vegetation on the Growth of Wool," and that the prize had been awarded to Dr. Ross. The Council had decided to insert Dr. Ross's paper in abstract in the volume for 1882. In the absence of Professor Liversidge, the honorary Editor, the Council had secured the services of a gentleman connected with the staff of the *Sydney Morning Herald* to prepare the abstract, to whom a fee of five guineas had been paid, which is included with other items under "sundry disbursements" in the Treasurer's annual statement.

The certificates of ten new candidates were read for the second time, and of three for the first time.

One hundred and fifty-six donations were laid upon the table.

A paper by Mr. PETER BEVERIDGE was read "On the Aborigines inhabiting the great Lacustrine and Riverine depression of the Lower Murray, Lower Murrumbidgee, Lower Lachlan, and Lower Darling."

A discussion followed, in which the following gentlemen took part, viz.:—Messrs. J. F. Mann, Clarendon Stuart, H. A. Gilliat, Revs. Robert Collie, Peter M'Pherson, and the Chairman.

About thirty-five members were present.

WEDNESDAY, 4 JULY, 1883.

Hon. Professor SMITH, C.M.G., President, in the Chair.

The minutes of the last meeting were read and confirmed.

Dr. Smith expressed his gratification at meeting the Society again after his long absence from the Colony, and returned his thanks for the honour done to him by re-election as President.

The following gentlemen were duly elected ordinary members of the society :—

Barnet, James, Sydney.
Fraser, John, B.A., West Maitland.
Maiden, Joseph Hy., Darlinghurst.
Morley, Fredk., Sydney.
Sinclair, Sutherland, Sydney.
Stuart, Professor T. P. Anderson, M.D., Sydney University.
Trebeck, Tom B., Elizabeth Bay.
Tuxen, Peter Vilhelm, Sydney.
Wardell, W. W., C.E., St. Leonards.
Wilkinson, W. Camac, M.B., Sydney.

The certificates of three new candidates were read for the second time, and of five for the first time.

Sixty-three donations were laid upon the table.

A paper by the Rev. J. E. TENISON-WOODS, F.G.S., F.L.S., &c., was read, "On the Waianamatta Shales."

A discussion followed, in which the following gentlemen took part, viz. :—Professor Liversidge, Messrs. C. Moore, F. B. Gipps, Rev. J. Milne Curran, and the Chairman.

Professor Liversidge communicated a paper by Mr. R. Etheridge, junior :—"Further Remarks on Australian Strophalosiæ, and Description of a new species of Aucella from the Cretaceous Rocks of North-east Australia."

Professor LIVERSIDGE exhibited some specimens of tin ore. He explained that most of the tin worked in this Colony was alluvial tin, though occasionally thin veins of crystallized tin had been met with. The specimens shown, however, were from a vein which had already been proved to a width of 10 feet, and the full width had not yet been reached. The tin, as could be seen, was disseminated through the felspar, and the specimen which came from the Stannifer Bischoff Mine, in New England, closely resembled the ore found in the St. Agnes Mine in Cornwall, England.

About forty members were present.

WEDNESDAY, 2 AUGUST, 1883.

Hon. Professor SMITH, C.M.G., President, in the Chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society:—

Schulze, Oscar, Sydney.
Smith, Robt. Burdett, M.L.A., Sydney.
Styles, George Mildinhall, Sydney.

The certificates of five new members were read for the second time, and of two for the first time.

Sixty-seven donations were laid upon the table.

A paper by Mr. EDWARD PALMER (M.L.A., Queensland) was read, "On Plants used by the Natives of North Queensland, Flinders and Mitchell Rivers, for food, medicine, &c., &c."

A discussion followed, in which the following gentlemen took part, viz.:—Messrs. W. A. Dixon, J. F. Mann, Dr. Rennie, T. W. Shepherd, J. Henry, and the Chairman.

It was announced that Mr. Trevor Jones's paper "On the Ventilation of Sewers and Dwellings," which was to have been read before the Society, had, on the recommendation of the Council, been submitted to the Board of Health.

Mr. J. TREVOR JONES then exhibited and explained the Macgregor Test, or Mining Indicator,—an instrument for determining, by means of a compass floating in gelatine, the deviation in diamond drill bores.

About thirty members were present.

WEDNESDAY, 5 SEPTEMBER, 1883.

CHARLES MOORE, F.L.S., V.-P., in the Chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society:—

Blaxland, Herbert, M.R.C.S.E., L.R.C.P, Lond., Callen Park Asylum.
Little, William, L.R.C.P., L.R.C.S., Edinburgh., Burwood.
Vause, Arthur John, M.B., C.M., Edinburgh, Cook's River.
Warren, W. H., C.E., The University, Sydney.
Whitelegge Thomas, Sydney.

The certificates of two new candidates were read for the second time, and of one for the first time.

The following letter from Dr. Louis Pasteur was read :—

[*Translation.*]

My dear Sir and Colleague, Paris, 3 July, 1883.

I have the pleasure to acknowledge the receipt of your letter, in which you inform me that the Royal Society of New South Wales has elected me an honorary member of the Society. I am very sensible of this mark of high esteem paid to me by the Royal Society in acknowledgment of my labours. By new efforts I shall endeavour to render myself more worthy of this dignity. I beg you to accept, my dear sir, my sentiments of the highest consideration, and I shall be glad if you will have the goodness to convey the expression of my gratitude to the members of the Society.

L. PASTEUR,
Member of the French Academy and Academy of Sciences.

To Professor Liversidge. F.R.S.,
Hon. Secretary Royal Society of New South Wales.

Eighty-nine donations were laid upon the table and acknowledged.

The following papers were read :—

1. "Notes on the Genus Macrozamia, with Descriptions of some new Species," by Charles Moore, F.L.S., V.-P.
2. "A List of Double Stars," by H. C. Russell, B.A., F.R.A.S.
3. "Some Facts connected with Irrigation," by H. C. Russell, B.A., F.R.A.S.
4. "On the Discolouration of White Bricks made from certain clays in the neighbourhood of Sydney," by E. H. Rennie, M.A., D.Sc.

A discussion took place upon the last-named paper, in which the following gentlemen took part, viz. :—Messrs. J. Henry, Dr. R. B. Read, A. Dean, P. N. Trebeck, C. S. Wilkinson, and Dr. Rennie.

Professor Liversidge, F.R.S., exhibited and described two new Universal Models for showing the crystallographic axes, which he had had constructed for lecture purposes.

Mr. J. K. Hume exhibited a collection of Carboniferous Marine Fossils which he had collected from the carboniferous beds at Cataract Creek, near Mount Wellington, Hobart, Tasmania.

Mr. C. S. Wilkinson said that these fossils were some of the finest specimens he had ever seen. Judging from his experience in this Colony, he believed that in the locality where these specimens were found, boring operations might lead to the discovery of workable deposits of coal or kerosene shale.

Professor Liversidge stated that the coal which was worked in the district was found to be much baked and disturbed by intrusions of igneous rocks, and that from his recollection of the locality, he was inclined to think that any deposits of oil-shale must have also been more or less deteriorated in quality and value.

Professor Liversidge exhibited a fossil specimen of an extinct chelonian reptile, *Notochelys costata*, Owen, found on the Flinders River, Queensland, which had been described by Professor Owen, who stated that it was the first chelonian found in Australia.

Dr. Wright exhibited a Swan's incandescent electric microscopic lamp of one and a-half candle power. It was so attached to a small workable arm that it could be easily used for investigating the throat or other internal portions of the body, where a strong light was required.

About forty members were present.

WEDNESDAY, 3 OCTOBER, 1883.

Hon. Professor Smith, C.M.G., in the Chair.

The minutes of the last meeting were read and confirmed

The following gentlemen were duly elected ordinary members of the Society :—

Garrett, Henry Edward, M.R.C.S.E., Sydney.
Goode, William Henry, M.D., Sydney.

The certificate of one new candidate was read for the second time, and of three for the first time.

Thirty-five donations were laid upon the table.

The following letter from Dr. Ottokar Feistmantel was read :—

Bohemian Polytechnic High School,
Prague, 29 July, 1883.

Dear Sir,

I acknowledge with thanks the receipt of your letter of the 17th May, informing me of the honor which has been conferred upon me by the Royal Society of N.S.W., and I would beg that you should communicate this my acknowledgment and my best thanks, at a next meeting of the Society.

Thanking again for your kind letter, believe me, Sir,

Most respectfully yours,
Dr. OTTOKAR FEISTMANTEL.

To Professor Liversidge, F.R.S., Hon. Sec.

A paper by Mr. H. Ling Roth, F.M.S., F.S.S., "On the Roots of the Sugar-cane," was read.

Remarks upon the same were made by Professor Liversidge, Messrs. H. E. Kater, and J. U. C. Colyer.

Mr. H. C. Russell exhibited Faure's Bichromate Battery.

The Hon. Professor Smith exhibited and explained Ayrton and Perry's Commutator Ammeter and Voltmeter.

Mr. Russell also exhibited a sample photograph of the Sun, which had been sent out to him from the South Kensington Museum.

About thirty members were present.

WEDNESDAY, 7 NOVEMBER, 1883.

H. C. Russell, B.A., F.R.A.S., &c., in the Chair.

The minutes of the last meeting were read and confirmed.

The following gentleman was duly elected an ordinary member of the Society:—

Byrne, William S., M.B., M.Ch., B.A., Sydney.

The certificates of three new members were read for the second time, and of four for the first time.

Eighty-eight donations were laid upon the table.

Professor Liversidge announced that a copy of the Society's Journal for 1882 had been received from the Government Printer, and he hoped soon to have a sufficient number of copies to distribute to members; the delay had arisen through press of business at the Government Printing Office.

The following specimens which had been received from Mr. Edward Palmer were laid upon the table for inspection, and described by Professor Liversidge:—

1. Fossil crocodile teeth from the Manfred Downs, Lower Flinders, Queensland.
2. Mineral specimen obtained from the bottom of a well 90 feet deep, on the Lower Flinders.
3. Copper ore from a new lode at the Cloncurry.

Professor Liversidge also described some fossils from Coogee Bay and Manly Beach, which were exhibited by Mr. E. Daintrey.

Mr. H. G. McKinney, M.E., read a paper on "Irrigation in Upper India."

A paper "On Tanks and Wells of New South Wales, Water Supply and Irrigation," by Mr. A. Pepys Wood, was communicated by Mr. W. H. Warren, C.E., and partly read.

The meeting was adjourned till the 14th inst., at 8 p.m.

About forty members were present.

WEDNESDAY, 14 NOVEMBER, 1883.

ADJOURNED MEETING.

Hon. Professor Smith, C.M.G., President, in the Chair.

The concluding portion of Mr. A. Pepys Woods' paper "On Tanks and Wells of New South Wales, Water Supply and Irrigation," was read by Mr. W. H. Warren, C.E.

It was resolved that any visitors present who might desire to speak upon the subject should be allowed to do so.

A discussion followed in which the following gentlemen took part, viz.:— Messrs. H. C. Russell, C. Moore, S. Pollitzer, H. G. McKinney, and W. Czarlinski.

About twenty-five members were present.

WEDNESDAY, 5 DECEMBER, 1883.

Hon. Professor SMITH, C.M.G., President, in the Chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society :—

Lane, William H. H., Sydney.
Ryley, J., Rutherford, M.D., Mudgee.
Shellshear, Walter, A.M.I.C.E., Paddington.

The certificates of four new candidates were read for the second time, and of three for the first time.

It was resolved that Messrs. W. G. Murray and P. N. Trebeck be appointed Auditors for the current year.

Seventy-eight donations of books, &c., and eight charts were laid upon the table.

Professor Liversidge announced that a communication had been received from the Franklin Institute respecting the International Electrical Exhibition in Philadelphia, to open September 2nd, 1884.

A paper by Baron Ferd. von Mueller, K.C.M.G., M.D., Ph. D. F.R.S., &c., on "Additions to the Census of the Genera of Plants hitherto known as indigenous to Australia," was read.

Professor Smith exhibited Stoke's apparatus for producing attraction and repulsion by vibrations of air.

Specimens collected by Dr. H. B. Guppy, of H.M.S. "Lark," were exhibited and described by Professor Liversidge; they included flints and flint cores from the islands of Ulana and Ugi.

A large mass of flint nearly 4 lbs in weight, from Ugi Island, and some waters from hot springs on the islands of Simbo and Santa Anna.

Professor Liversidge drew attention to the form of the large mass of flint, which clearly showed traces of artificial working, and was evidently a large stone axe or tomahawk.

The following notes on their occurrence are from Dr. Guppy's letters to Professor Liversidge :—

These flints are commonly found in the island of Ugi, embedded 1 or 2 inches below the surface soil, and are exposed in numbers when the soil is disturbed for purposes of cultivation. I have seen similar flints from the opposite coast of St. Christoval, where they occur under similar circumstances. In Ugi they are found on the low land which fringes the coast—which varies in elevation from 5 to 12 or 15 feet above the high-water level : fragments of decayed coral and portions of shells are frequently intermingled in the soil where flints are found. In addition to common flint, which composes the majority of these masses, fragments of chalcedony, cornelian, and a jasper also occur. If I remember aright, all the specimens which I send are fragments of nodules. Their resemblance in some instances to flint implements of the palæolithic age is worthy of notice : one flake is coloured white, and reminds one of the similarly shaped flakes of the post tertiary gravels. The prevailing rock of the island of Ugi is an earthy foraminiferous limestone.

I made a careful examination of the natural sections of this rock, which were displayed in the deep gorges worn by the streams, but I never came upon embedded flints. I am informed by resident traders that flints are abundant on the beach of the island of Ulana, together with fragments of a white rock like chalk. I was unable to visit this island of Ulana.

I may state that in my short experience I have met with islands of very varied geological character. The large islands such as St. Christoval and Florida appear to be formed of an axis of primitive eruptive and metamorphic rocks—flanked by more recent volcanic formations, and fringed near the coast by elevated coral-limestone reaching to a height in some instances of several hundred feet above the sea. In Florida I traced the coral limestone —often indistinguishable from the compact rock of the existing coral reef— to a height of 900 feet above the sea.

Then comes the volcanic type of island *e.g.* Simbo, which is entirely of trachytic rocks, and still retains an old funnel-shaped crater, a solfatara, numerous fumaroles even on the highest summit, and boiling springs.

Then we have the raised atoll, such as Santa Anna, which, elevated some 500 feet above the sea, offers interesting confirmation to Mr. Darwin's theory of coral islands.

In one instance I succeeded in finding, *in situ* beneath the crust of coral-rock, the crystalline eruptive rock of the original island before it underwent subsidence and became clothed with coral.

The island of Ugi presents yet another variety of geological structure: a low-lying island, it is composed of bedded foraminiferous limestone—once incrusted with coral-rock, which is now to a great extent removed by denudation: flints occur in the surface soil—though I have not yet found them *in situ*. I intend however to continue my observations on this island.

Professor Liversidge remarked that some years ago Mr. Brown, the Wesleyan missionary, brought from New Britain a soft white limestone which was quite undistinguishable from chalk, not only physically but chemically, and pointed out that this discovery of flints afforded another very strong proof of the probable presence of true chalk of Cretaceous age in the South Sea Islands.*

Samples of Water from the Islands of Simbo and Santa Anna, collected by Dr. H. B. Guppy, Surgeon, H.M.S. "Lark."

Bottle No. 49, containing water from the fresh-water lake of Wailava in the island of Santa Anna, collected in April, 1882. I have seen no reference to this lake in any of the works which bear on these islands. The island of Santa Anna has the characters of a raised atoll with the large central depression occupied by its lowest part by the waters of the lakes of Wailava and Waipiapia. Wailava is about half a mile across in length, and has a depth of 15 fathoms as ascertained by Lieut. Oldham. On carefully examining this lake, I found that its waters are about the sea-level, though they are not affected by the rise and fall of the tides. On one side it is only separated from the sea by a low swampy tract about one-third of a mile across and not elevated more than twenty feet above the sea. The surface of this tract is strewn with coral

* See Journal of the Royal Society of N.S.W. for 1877, Vol. XI.

fragments, and the more swampy portion abounds with Auriculæ. It is evident that this lake has been only cut off from the sea by recent elevation.

On making a rough examination, I found the density about that of fresh water, with *chlorides* abundant, *lime* two or three grains per gallon, *ammonia* unmistakeable, *taste* flat and fresh: rapidly decolourizes a solution of permanganate of potash.

Bottles 142 and 143, containing water from the boiling spring in the island of Simbo, collected in May, 1882. The island of Simbo is formed of trachytic rocks, and contains in the southern part an extinct crater, a solfatara, and numerous fumaroles which pierce the rocks, occurring from the sea-level up to the highest summit about 1,100 feet above the sea. This water was collected from the boiling-spring on the shores of a lagoon (very probably an old crater) on the south-west side of the island. The spring is placed amongst decomposed trachytic rocks, a foot or two above the sea-level: its temperature in 212°, and large quantities of H_2S are exhaled. Iron oxide stains the rocks around, which are encrusted with sulphur and chloride of sodium in some places. Numerous fumaroles pierce the slope overlooking the springs; sulphur, alum, milk-white opal, &c., form deposits around their orifices. As this spring is close to the edge of the lagoon of salt water, with the tidal movements of which its waters rise and fall, I am of opinion from a cursory examination of the water that its composition may be regarded as sea-water, plus the substances discharged by a fumarole.

Bottle 150. Water condensed from one of the fumaroles in the solfatara on the south-west point of Simbo, in May, 1882. A little sulphur, which unavoidably fell in, forms a sediment at the bottom of the bottle. For two hours the thermometer retained in the orifice of the fumarole varied only between 208° and 210° F. Watery vapour, sulphuretted hydrogen, and sulphurous acid were evolved, flaky crystals of sulphur encrusting the sides of the aperture; a strip of paper soaked in a solution of acetate of lead was immediately blackened; and the black metallic silver sulphide was formed in the interior of a piece of glass-tubing moistened with silver nitrate, whilst the presence of sulphurous acid appeared to be indicated by the suffocating smell of burning sulphur, by the presence of sulphur deposits, and by the reddening of litmus paper. No turbidity was produced in lime-water, nor was the presence of hydrochloric acid gas shown on exposing a solution of silver nitrate. The interior of the solfatara was whitened by the decomposing influence of the vapours evolved. The elevation of the fumarole in question was rather under 300 feet above the sea.

Bottle 151. Water condensed May, 1882, from one of the fumaroles on the summit of the South Hill in the island of Simbo, elevated about 1,100 above the sea. The temperature of the

fumarole varied during two hours between 175° and 180° F. Employing the same rough field tests, I ascertained that watery vapour was the principal substance discharged; no effect was produced on acetate of lead, silver nitrate, or lime-water, and litmus paper was only slightly reddend after a prolonged exposure. No deposits were formed around the orifices of the fumaroles on this hill-summit. The trachytic rock was much decomposed, and a little of the decomposed rock unavoidably fell in, and forms a sediment at the bottom of the bottle.

Bottle 339, containing two kinds of fleshy fruits ejected from the crops of pigeons shot by Lieutenants Heming and Leeper, on a small island off the south coast of St. Christoval. I am rather desirous to learn the nature of these fruits, as it bears on the subject of the remarkable rapid appearance of trees and other vegetation on the numerous islets which are now forming on the rising coral reefs which fringe the coast of St. Christoval.

The egg-shaped fruit is red, and the round fruit blue, in their natural state.

The fruits were afterwards examined by Mr. Moore, F.L.S., who states that he thought the blue fruit to be a species of *Elæocarpus*, and the red fruit that of a palm, probably a *Kentia*; the largest of the three is commonly known as the native almond of the Solomon Islands, but as there are neither leaves nor flowers no determination could be made.

About thirty members were present.

ADDITIONS

TO THE

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DONATIONS—1883.

(The names of the Donors are in *Italics.*)

TRANSACTIONS, JOURNALS, REPORTS, &c.

ABERDEEN :—The Aberdeen University Calendar for the Academical Year, 1883–84. *The University.*

ADELAIDE :—Report of the Progress and condition of the Botanic Garden and Government Plantations during 1882. *The Government Botanist.*

Meteorological Observations made at the Adelaide Observatory during 1880. *The Observatory.*

Annual Report of the South Australian Institute, 13th October, 1883. *The Institute.*

Transactions and Proceedings, and Report of the Royal Society of South Australia. Vol. V, 1881–82. *The Society.*

AMSTERDAM :—Jaarboek van de Koninklijke Akademie van Wettenschappen, 1881. *Royal Academy of Sciences, Amsterdam.*

BALLAARAT :—Annual Report of the School of Mines, 19 January, 1883.
Ballaarat Science Lectures. First Series, 1882. *The School of Mines.*

BALTIMORE :—Studies from the Biological Laboratory. Vol. II, No. 4.
American Journal of Philology. Vol. III, No. 12, and Supplement.
" " " " IV, " 13 and 14.
American Chemical Journal " IV, " 5 " 6.
" " " " V, " 1 to 5.
American Journal of Mathematics. Vol. V, Nos. 2, 3, and 4.
" " " " VI, " 2.
Johns Hopkins University Circulars. Vol. II, Nos. 20, 21, 22, 25, 27. *The Johns Hopkins University.*

BERLIN :—Monatsbericht der Königlich Preussischen Akademie der Wissenschaften zu Berlin.
September, October, December, 1881.
Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin. Nos. 1 to 17, incl. 1 January to 2 March, 1882.
" 39 to 54 " 19 October to 21 Dec., "
" 1 to 37 " 11 January to 26 July, 1883.
Index. Erster Halbband Januar bis Mai Stück I—XXVI. *The Academy.*

BISTRITZ (in Siebenbürgen) :—Jahresbericht der Gewerbeschule zu Bistritz, Part IX, 1882–83.
Ecole Industrielle à Bistritz en Transylvanie (Hongrie).

BOSTON (Mass. U.S.A.) :—Memoirs of the American Academy of Arts and Sciences.
Centennial, Volume XI, Part I. *The Academy.*
Memoirs of the Boston Society of Natural History. Vol. III, Part II, Nos. 4 and 5.
Proceedings ,, ,, ,, XX, ,, 4, 1880.
Proceedings ,, ,, ,, XXI, Parts 1, 2, 3, 1880–81. *The Society.*

BREMEN :—Abhandlungen herausgegeben vom Naturwissenschaftlichen Verein zu Bremen. Band VIII, Heft 1. *The Society.*

BRISBANE :—Acclimatisation Society of Queensland—
Report of the Council for the year 1882. *The Society.*

BRISTOL :—Proceedings of the Bristol Naturalists' Society. Vol. I, Parts 1, 2, 3. 1873–1876.
Proceedings of the ,, ,, ,, ,, II, ,, 1, 2, 3. 1877–1879.
Proceedings of the ,, ,, ,, ,, III, ,, 1, 2. 1880. *The Society.*

BRUSSELS :—Procès-Verbaux des Séances de la Société Royale Malacologique de Belgique. Tome XI. April 1, May 6, June 3, July 2. 1882.
Annales de la Société Royale Malacologique de Belgique.
Tome XI, Second Series, Tome I. 1876.
XII, ,, ,, ,, II. 1877.
XIII. ,, ,, ,, III. 1878.
XIV. ,, ,, ,, IV. 1879.
XVI. Third ,, ,, I. 1881. *The Society.*
Annuaire de l'Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique. 1882–1883.
Bulletin ,, ,, ,, ,,
Année 50, Série 3, Tome I. 1881.
,, ,, ,, ,, ,, II. ,,
,, 51, ,, ,, ,, III. 1882.
,, ,, ,, ,, ,, IV. ,,
,, 52 ,, ,, ,, V. 1883. *The Academy.*

CAEN :—Mémoires de l'Académie Nationale des Sciences, Arts et Belles-Lettres de Caen. 1880, and Volume Supplémentaire. 1880.
,, ,, 1881.
,, ,, 1882. *The Academy.*

CALCUTTA :—Asiatic Society of Bengal—
Proceedings, Nos. 7, 8, 9, 10. 1882.
,, ,, 1, 2, 3, 4, 5, 6, 7, 8. 1883.
Journal, Vol. LI. Part I. Nos. 3 and 4, 1882.
,, ,, ,, ,, II. ,, 2, 3, and 4, 1882.
,, ,, LII. ,, I. ,, 1 and 2, 1883.
,, ,, ,, ,, II. No. 1, 1883.
Extra number to Part I. for 1882.
The Society.
Memoirs of the Geological Survey of India, Vol. XIX. Parts 1, 2, 3, and 4.
,, ,, ,, Vol. XX.
The Superintendent of the Geological Survey of India.

CALCUTTA—*continued.*
Records of the Geological Survey of India. Vol. XV. Parts 1, 2, 3, and 4.
" " " Vol. XVI. " 1, 2, and 3.
Memoirs of the Geological Survey of India. (Palæontologia Indica):—
Series X. Vol. II. Parts I. to V., inclusive.
" XII. " IV. " I.
" XIII. " I. " III. and IV. Fasc. 1 and 2.
" XIV. " I. " III. Fasc. 2.
The Superintendent of the Geological Survey of India.

CAMBRIDGE:—Proceedings of the Cambridge Philosophical Society. Vol. IV. Parts II. to V. inclusive. Lent, 1881, to Michaelmas, 1882.
Transactions of the Cambridge Philosophical Society. Vol. XIII. Part II. 1882. *The Society.*
Twenty-eighth Annual Report of the Cambridge Public Free Library. 1882–1883. *The Library.*
Twenty-ninth Annual Report of the Cambridge University Library, 6 June 1883. *The University.*

CAMBRIDGE (MASS., U.S.A.):—Annual Report of the Cambridge Entomological Club for 1882.
"Psyche." Vol. III. Nos. 99 and 100.
" " IV. " 105 to 114 inclusive. *The Club.*
Bulletin of the Museum of Comparative Zoology at Harvard College.
Vol. VI. Part II. No. 12.
" X. Nos 2 to 6 inclusive.
" XI. " 1, 2 and 4.
Whole Ser. Vol. VII. Geological Ser. Vol. 1. Nos. 9 and 10.
Annual Report of the Curator of the Museum of Comparative Zoology at Harvard College. 1881–1882. *The Museum.*
"Science." Vol. II. No. 40. November 9, 1883.
The Science Company.

CAPE TOWN:—Transactions of the South African Philosophical Society, Vol. II. Part III. 1880–81. *The Society.*

CARLSRUHE.—Programm der Grossherzoglich Badischen Polytechnischen Schule zu Carlsruhe, 1880–1881.
The Grand-ducal Polytechnical School.
Verhandlungen des Naturwissenschaftlichen Vereins in Karlsruhe, Heft IX. *The Society.*

CASSEL:—Bericht des Vereines für Naturkunde zu Cassel. Vol. XXVIII. 1880–1881. *The Society.*

CHRISTIANIA:—Memoirs of the Norwegian North Atlantic Expedition, 1876–78.
VIII. Zoology, Mollusca. 1. Buccinidæ, by Herman Friele.
IX. Chemistry. 1. On the solid matter in sea-water, by Ludvig Schmelck.
2. On Oceanic Deposits, by Ludvig Schmelck.
X. Meteorology, by H. Mohn. *The Editorial Committee.*

CINCINNATI (OHIO):—Scientific Proceedings of the Ohio Mechanics Institute, Vol. 1. No. 4. December, 1882. *The Institute.*

COPENHAGEN:—Memoires de la Société Royale des Antiquaires du Nord.
Nouvelle Série, 1880.
" 1881.
" 1882–83.
" 1884. *The Society.*

DIJON:—Mémoires de l'Académie des Sciences, Arts, et Belles-Lettres de Dijon. Vol. VII. Ser. 3. 1881–1882. *The Academy*

DRESDEN :—Mittheilungen aus dem Kœniglichen Mineralogisch-Geologischen und Præhistorischen Museum in Dresden. Heft IV. 1881.
i.e. Die Fische aus dem Lithog. Schiefer.
Zeitschrift für Museologie und Antiquitätenkunde sowie für verwandte Wissenschaften. Jahrgang 3. 1880.
Archiv für Litteraturgeschichte, edited by Dr. Franz Schnorr von Carolsfeld. Band X. Heft 1 to 4. iuclusive. 1880–81.
Verzeichniss der Neuen Werke der Königl öffentlichen Bibliothek zu Dresden. 1880.
Die Decorative Kunst, &c.
Lieferung 7. Blatt 61 to 70.
„ 8. „ 71 to 80.
Königl. Ethnographisches Museum zu Dresdren. Heft 1.
i.e. Bilderschriften des Oestindischen Archipels und der Südsee, by Dr. A. B. Meyer. (With 6 plates.)
The Director-General of the Royal Collections of Art and Science.

Die Meteoriten des Konigl. Mineralogischen Museums in Dresden, von A. Purgold. 1882. *The Director of the Museum.*

Zeitschrift des Königl. Sächsischen Statistischen Bureaus.
Jahrgang XXVII. Heft 1 to 4. 1881.
„ XXVIII. „ 1 to 4. 1883.
The Royal Statistical Bureau.

Bericht über die Verwaltung der Königlichen Sammlungen für Kunst und Wissenschaft zu Dresden, in den Jahren, 1880 and 1881.
The Royal Public Library.

DUBLIN :—Proceedings of the Royal Irish Academy—
Science. Vol. III. Ser. II. Parts VII. and VIII.
Polite Literature and Antiquities. Vol. II. Ser. II. Part III.
Transactions of the Royal Irish Academy—
Science. Vol. XXVIII. Parts VI. to X. inclusive.
The Academy.

EDINBURGH :—Transactions of the Edinburgh Geographical Society—
Vol. IV. Part 2. *The Society.*

Proceedings of the Royal Physical Society—
Session 1881–82. *The Society.*

FLORENCE :—Archivio per l'Antropologia e la Etnologia—
Vol. XII. Fasc. 3. 1882.
„ XIII. 1 and 2. 1883. *The Society.*

Bullettino della Società Entomologica Italiana.
Trimestre. 1—4. 1879.
„ 1—4. 1880.
„ 1—4. 1881. *The Society.*

FRANKFURT, A/M. :—Bericht über die Senckenbergische Naturforschende Gesellschaft. 1880–1881 and 1881–1882.
Abhandlungen „ „ „
Band XII. Heft 3 and 4. 1881.
„ XIII. „ 1 and 2. 1883. *The Society.*

GENEVA :—Bulletin de l'Institut National Génevois.
Tome XXV. 1883. *The Institute.*

GLASGOW :—The Glasgow University Calender for the year 1883–84.
The University.

GÖTTINGEN :—Nachrichten von der Königlichen Gesellschaft der Wissenschaften und der Georg-August-Universität. Nos. 1—16. 1881.
The Royal Society of Sciences.

HALIFAX (Novia Scotia):—Proceedings and Transactions of the Nova Scotian Institute of National Science—
Vol. V. Part IV. 1881-2. *The Institute.*

HALLE, A/S.:—Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum—
Vol. XLII. 1881.
„ XLIII. 1882.
Leopoldina. Heft 17. 1881.
„ „ 18. 1882.
The Imperial Leopold-Carolus Academy of German Naturalists.

HAMBURG:—Mittheilungen der Geographischen Gesellschaft in Hamburg.
Heft II. 1880–81. *The Society.*

HEIDELBERG:—Verhandlungen des Naturhistorisch-Medicinischen Vereins zu Heidelbeg.
N. F. Band III. Heft 2. 1882. *The Society.*

HOBART:—Monthly Notices of Papers and Proceedings and Report of the Royal Society of Tasmania for 1882. *The Society.*

IOWA CITY (Iowa):—Second Biennial Report of the Central Station of the Iowa Weather Service.
Notes on Cloud Forms and the Climate of Iowa.
Annual for 1883. *The Director of the Iowa Weather Service.*

JENA:—Jenaische Zeitschrift für Naturwissenschaft, herausgegeben von der Medicinisch-Naturwissenschaftlichen Gesellschaft zu Jena.
Band XVI. N.F. Band IX. Heft 1 and 2. 1882.
„ „ „ „ „ 3 and 4. 1883. *The Society.*

KÖNIGSBERG:—Schriften der Physikalisch-ökonomischen Gesellschaft zu Königsberg.
Jahrgang XXI. Abtheilung 2. 1880.
„ XXII. „ 1 and 2. 1881.
„ XXIII. „ 1 and 2. 1882. *The Society.*

LAUSANNE:—Bulletin de la Société Vaudoise des Sciences Naturelles—
Vol. XVIII. No. 88. 1882. *The Society.*

LEEDS:—The Journal of Conchology—
Vol. IV. Nos. 1, 2, 3. 1883. *The Conchological Society.*
Sixty-third Annual Report of the Council of the Leeds Philosophical and Literary Society. 1882–83. *The Society.*

LIÉGE:—Annales de la Société Géologique de Belgique—Tome I. 1874.
Adresse aux Chambres Legislatives au sujet de la Carte Géologique de la Belgique, 21 Jan., 1883. *The Geological Society of Belgium.*

LILLE:—Annales de la Sóciéié Geologique du Nord—Vol. IX. 1881–82.
The Geological Society of the North.

LONDON:—Anthropological Institute of Great Britain and Ireland.
Journal. Vol. XII. Nos. 1, 2, 3, 4.
„ „ XIII. „ 1. *The Institute.*
Institution of Civil Engineers. Charter, By-laws, and List of Members, 1883. *The Institution.*
Institution of Naval Architects—
Transactions. Vol. XIX., 1878.
XXIII., 1882.
XXIV., 1883. *The Institution.*

LONDON—*continued.*

Linnean Society—

Journal—Botany—Vol. XIX. No. 122.
—Vol. XX. No. 123-129 inclusive.

Zoology—Vol. XVI. No. 96.
—Vol. XVII. No. 97-101 inclusive.

Proceedings.—From November, 1880, to June, 1882. *The Society.*

Meteorological Office.—Rainfall Tables of the British Isles, 1866–1880. Official No. 47.

Report of the Meteorological Council to the Royal Society, for the year ending 31 March, 1882.

The Quarterly Weather Report, 1879. Official No. 49.

The Quarterly Weather Report, 1880. (Appendices and Plates.) Official No. 50.

The Quarterly Weather Report, 1877. (Appendices and Plates.) Official No. 52.

Hourly Readings, 1881. Parts 1, 2, 3, 4. January-December. Official No. 51. *The Meteorological Office.*

Meteorological Society—

Quarterly Journal—Vol. VIII. No. 44.
IX. No. 45.

Meteorological Record, Nos. 6, 7, 8. 1882.

Instructions for the observation of Phenological Phenomena (second edition), 1883. *The Meteorological Society.*

Pharmaceutical Society of Great Britain. Journal and Transactions—

Parts 148–150 inclusive. 1882.
Parts 151–160 inclusive. 1883.
Calendar, 1883. *The Society.*

Physical Society of London. South Kensington Museum. Proceedings—
Vol V. Parts 3 and 4. *The Society.*

Quekett Microscopical Club—

Journal Series II.—Vol. 1. Nos. 2–6 inclusive.
General Index—Vols. I.-VI. inclusive. *The Club.*

Royal Asiatic Society of Great Britain and Ireland. Journal—
Vol. XIV. Part 4.
XV. Parts 1–4 inclusive. *The Society.*

Royal Agricultural Society of England. Journal—
Vol. XIX. Part 1. No. 37. 1883. (Second series.) *The Society.*

Royal Astronomical Society. Monthly Notices—
Vol. XLII. No. 9.
Vol. XLIII. No. 1-7 inclusive and 9. *The Society.*

Royal Colonial Institute. Proceedings—
Vol. XIV. 1882–83. *The Institute.*

Royal Geographical Society. Proceedings—
Vol. IV. No. 11, 12. 1882.
Vol V. No. 1-11 inclusive. 1883. *The Society*

Royal Historical Society. Transactions. New series—
Vol. I. Parts 1, 2, 3. 1883. *The Society.*

Royal Institution of Great Britain. Proceedings—
Vol. X. Part 1. No. 75. 1882. *The Institution.*

Royal Microscopical Society. Journal. Series II.—
Vol. II. Part 6.
Vol. III, 1–5 inclusive. *The Society.*

LONDON—*continued.*
Royal Society—
Proceedings—Vol. XXXIV. No. 220-223.
Philosophical Transactions—Vol. 173. Parts 2, 3, 4.
" " " 174. Part 1.
Library Catalogue. Part II. General Catalogue. 1883.
List of Fellows. 30 November, 1882. *The Society.*
Royal United Service Institution—
Journal—Vol. XXVI. No. 117, 118, 1882, and Index to Vol. XXVI.
" " XXVII. No. 119, 120, 1883.
List of Members to 15 April, 1883. *The Institution.*

MANCHESTER :—Transactions of the Manchester Geological Society—
Vol. XV. Parts 1-9. *The Society*

MARBURG :—Gesellschaft zur Beförderung der gesammten Naturwissenschaften in Marburg—
Schriften Band XI. Abhandlung 7.
" " XI. Supplement Heft 5.
Sitzungsberichte, 1880.
" 1881. *The Society for the Advancement of Natural Sciences.*

The University—Forty-five Medical Theses. *The University.*

MELBOURNE :—Fragmenta Phytographiæ Australiæ. By Baron Ferd. von Mueller, K.C.M.G. F.R.S., &c.—
Vol. II. 1860-1861.
Vol. VI. 1867-1868.
Observations on New Vegetable Fossils of the Auriferous Drifts. By Baron Ferd. von Mueller, K.C.M.G., F.R.S., &c. Second Decade, 1883.
The Plants indigenons around Sharks' Bay and its vicinity (Western Australia), enumerated by Baron Ferd. von Mueller, K.C.M.G., F.R.S.
Systematic Census of Australian Plants. By Baron von Mueller, K.C.M.G., F.R.S., &c. *The Government Botanist.*
Agricultural Statistics, 1881-1882.
" " 1882-1883.
Statistical Register of the Colony of Victoria—
Parts V.-IX. inclusive. 1881.
Parts I.-VI. inclusive. 1882.
Fourth Annual Report in connection with Friendly Societies, 1881.
Victorian Year Book for 1881-2.
Census of Victoria, 1881. Parts V., VI.
" " 1881. General Report, with Summary Tables, Diagrams and Map. *Government Statist.*
Mineral Statistics of Victoria for 1882.
Observations on New Vegetable Fossils of the Auriferous Drifts. By Baron Ferd. von Mueller, K.C.M.G., M.D., Ph.D., F.R.S. Second Decade, 1883.
Report of the Chief Inspector of Mines for 1882.
Report of the Inspector of Explosives for 1882.

Reports of the Mining Surveyors and Registrars—
Quarter ended 31 December, 1882.
" " 31 March, 1883.
" " 30 June, 1883.
" " 30 September, 1883.
The Hon. the Minister of Mines.

MELBOURNE—*continued.*
Report of the Trustees of the Public Library, Museums, and National Gallery of Victoria, 1882. *The Trustees.*
Transactions and Proceedings of the Royal Society of Victoria. Vol. XIX. *The Society.*
The Melbourne University Calendar for the Academic Year 1882–83. *The University.*

MIDDLESBORO':—The Journal of the Iron and Steel Institute. No. 2, 1882. No. 1, 1883. *The Institute.*

MINNEAPOLIS:—Bulletin of the Minnesota Academy of Natural Sciences. Vol. II. Nos. 2 & 3. *The Academy.*

MODENA:—Memorie della Regia Accademia di Scienze, Lettere ed Arti in Modena. Tomo XX. Parte 1, 2. 1880.
Opere presentate nel 1881, 1882. *The Academy.*

MONTPELLIER:—Académie des Sciences et Lettres de Montpellier—
Mémoires de la Section des Sciences. Tome IX. Fasc. 3. 1879. *The Academy.*

MONTREAL:—Mémoires de la Société Historique de Montreal. Neuvième Livraison, 1880. *The Society.*

MOSCOW:—Bulletin de la Société Impériale des Naturalistes de Moscow.
Vol. LVI. No. 4, 1881.
„ LVII. „ 1, 2, 3, 4. 1882, and Supplement.
„ LVIII. „ 2. 1883.
Table Générale et Systématique des Matiéres contenues dans les premier 56 vols. 1829–81. *The Society.*

MULHOUSE:—Bulletin de la Société Industrielle de Mulhouse.
September to December, 1882.
January to October, 1883. *The Society*

MÜNCHEN:—Sitzungsberichte der math-physik-classe der K. B. Akademie der Wissenschaften zu München. Heft 2, 3, 4. 1881.
„ 1. 1882.
Abhandlungen „ „ Band XIV. Abth. 1, 2. *The Academy.*

NAPLES:—Mittheilungen aus der Zoologischen Station zu Neapel—
Band IV. Heft 1, 2, 3. 1883 *Dr. Dohrn, Zoological Station.*
Bollettino della Società Africana—
Anno I. Fasc 5 & 6. 1882. *The Society.*
„ II. „ 1 & 4. 1883.

NEWCASTLE-UPON-TYNE:—Report of General Meeting of the Newcastle-upon-Tyne Chemical Society—Vol. V. Parts 11 & 12. 1882. *The Society.*
Transactions of the North of England Institute of Mining and Mechanical Engineers. Vol. XXXI. 1881-2. *The Institute.*

NEUCHATEL—Bulletin de la Société des Sciences Naturelles de Neuchatel—
Tome XII. Cahier 3. 1882. *The Society.*

NEW YORK:—American Chemical Society—
Journal, Vol. III. Nos. 7–12 incl. 1881. *The Society.*
New York Academy of Sciences—
Transactions Vol. I. No. 2, 3, 4, 5.
Annals „ II, „ 7, 8, 9.
List of Duplicates in the Library. Nov., 1880.
List of Deficiencies „ Nov., 1881. *The Academy.*

OXFORD :—Ashmolean Society—
Journal of the Proceedings. No. IV.
Reports and Accounts for the years 1880 & 1881. *The Society.*
Bodleian Library—
Donations to the Library during the fourteen months ending 31 December, 1882. *The Library.*
Radcliffe Library (Oxford University Museum)—
Catalogue of Books added during 1882. *The Trustees.*
Radcliffe Observatory—
Results of Astronomical Observations. Vol. XXXVIII. 1880. *The Trustees.*

PARIS :—Académie des Sciences de l'Institut de France—
Résumé des mesures effectuées sur les épreuves daguerriennes du passage de Vénus en 1874; obtenues par la Commission française, par MM. H. Fizeau et A. Cornu. *The Academy.*
Ecole Polytechnique—
Journal. Tome XXX. Cahier 49. 1881.
„ „ XXXI. „ 50. „
„ „ 51. 1882.
„ „ 52 „ *The Polytechnic School.*
Société d'Anthropologie de Paris—
Bulletins. Série III. Tome VI. Fasc 1, 2, 3, 1883. *The Society.*
Société d'Encouragement pour l'Industrie Nationale—
Bulletin. Série III. Tome IX. 1882. *The Society.*
Société de Géographie—
Bulletin. 7 Série. Tome III. Trimestre 4. 1882.
„ „ „ IV. „ 1, 2, 3, 1883.
Compte Rendu des Sciences de la Société de Géographie.
Nos. 1–14 incl. 1883. *The Society.*
Société Zoologique de France—
Bulletin. Tome I. 1876.
„ „ II. 1877.
„ „ III. 1878.
„ „ IV. 1879.
„ „ V. 1880.
„ „ VI. 1881.
„ „ VII. Partie 1–6. 1882.
„ „ VIII. „ 1, 2, 3, 4, 6. 1883. *The Society.*

PENZANCE :—Royal Geological Society of Cornwall. Catalogue of the Library. *The Society.*

PHILADELPHIA :—Academy of Natural Sciences—
Proceedings, Parts 1, 2, 3, 1881.
„ Part 1, 1883. *The Academy.*
American Entomological Society—
Transactions, Vol. IX, Nos. 1-4, 1881-2.
„ „ X, No. 1. *The Society.*
Announcement of the Wagner Feee Institute of Science for the Collegiate Year 1883. *The Institute.*
American Philosophical Society—
Proceedings, Vol. XIX. No. 109, June-December, 1881.
„ „ XX, Nos. 110, 111, January-June, 1882.
The Society.
Franklin Institute—
Journal, Vol. 110, No. 659.
„ „ 111, No. 664.
„ „ 112, Nos. 670-671.
„ „ 113, No. 673.
„ „ 115, Nos. 685-690 inclusive.
„ „ 116, Nos. 691-695 „ *The Institute.*

PISA :—Atti della Società Toscana di Scienze Naturali.
Memorie, Vol. V., Fasc. 2, e ultimo 1883.
Processi Verbali, Vol. III, 1 July, 1883. *The Society.*

PLYMOUTH :—Plymouth Institution and Devon and Cornwall Natural History Society.
Annual Report and Transactions, Vol. VIII, Part 1, 1881-82. *The Institution.*

PRAGUE :—Königl. Böhmische Gesellschaft der Wissenschaften in Prag.
Abhandlungen der Math-naturw., philos., &c., classe.
Folge VI, Band. 11, 1881-1882.
Jahresbericht, 1881.
" 1882.
Sitzungsberichte, 1881. *The Royal Bohemian Society of Sciences.*

PRINCETON, N.J. :—E. M. Museum of Geology and Archeology of Princeton College.
Bulletin, No. 3, May, 1883.
Palæontological Bulletin, No. 3. *The Museum.*

ROME :—Atti dell' Accademia Pontificia de' Nuovi Lincei.
Vol. XXXIV, Sessione VI.[a]
" XXXV, " VI.
" XXXVI, " I[a], II[a], III[a], IV[a].
The Academy.
Atti della R. Accademia dei Lincei.
Vol. VII, Fasc. 1 to 11, inclusive.
Alla Memoria di Alessandro Manzoni (Gazetta Italiano Illustrata, 22 May, 1883.) *The Academy.*
Bollettino R. Comitato Geologico d'Italia.
Nos. 9-12, inclusive, 1882.
Nos. 1-8, " 1883.
The Royal Geological Committee of Italy.
Bollettino della Società Geographica Italiana.
Vol. V, Fasc. 10.
" VI, " 1.
" VII " 1-6, inclusive, and 12.
" VIII " 1, 2, 3, 4, 5, 7, 9, 10, 11.
Terzo Congresso Geographico Internazionale.
Vol. I. *The Italian Geographical Society.*

SALEM :—American Association for the advancement of Science.
Proceedings of meeting held at Boston, Mass., Vol. 29, Parts 1 and 2, 1880. *The Association.*
Essex Institute—
Bulletin, Vol. 13, Nos. 1-12, 1881.
Historical Collections, Vol. XVIII, Parts 1-4, 1881.
The Fifth Half Century of the Arrival of John Winthrop at Salem, Mass.
The Flora of Essex County, Massachusetts, by John Robinson.
The Life and Services to Literature of Jones Very. *The Institute.*
Peabody Academy of Science—
Primitive Industry, by Charles C. Abbott, M.D., 1881.
The Academy.

ST. LOUIS (Mo.) :—Transactions of the Academy of Science of St. Louis—
Vol. IV. No. 2, 1880-81. *The Academy.*

ST. PETERSBURG :—Bulletin de l'Académie Impériale des Sciences.
Tome XXVII. Nos. 3 and 4. 1881.
" XXVIII. " 1. 1882. *The Academy.*

STUTTGART :—Württembergische Jahrbücher für Statistik und Landeskunde, herausgegeben von dem K. Statistisch-Topographischen Bureau. Band, I. Hälfte 2. 1882.
,, II. ,,
,, I. Hälfte 1. 1883.
,, II. ,, 1. ,,
The Royal Statistical Topographical Bureau.
Jahreshefte des Vereins für Vaterländische Naturkunde in Württemberg. Jahrgang XXXIX. 1883.
The Society of the Natural History of Württemberg.

SYDNEY :—Amsterdam Exhibition Commission, 1883.
New South Wales : it Progress and Resources and Official Catalogue of Exhibits from the Colony. *The Commission.*
Australian Museum—
Catalogue of a Collection of Fossils in the, 1883.
Guide to the Contents of the, 1883.
Report of the Trustees for 1882. *The Trustees.*
Colonial Secretary's Office—
Nouvelle-Calédonie et Dependances. Rapport Médical sur les Accidents qui ont suivi plusieurs blessures par flèches prétendues empoisonnées dans les îles du Pacifique, 1883.
The Hon. The Colonial Secretary.
Free Public Library—
Report from the Trustees for 1882. *The Trustees.*
Government Printing Office—
The Statutes of New South Wales passed during Session of 1883.
The Government Printer.
Linnean Society of New South Wales—
Proceedings. Vol. VII. Part 4.
,, ,, VIII. ,, 1, 2, 3. *The Society.*
New South Wales Medical Board—
Register of Medical Practioners for 1883. *The Board.*
Royal Mint, Sydney—
Annual Reports of the Deputy Master of the Mint, London, first to the thirteenth, 1870 to 1882 (incl).
Report of the Deputy Master of the Mint, London, on European Mints, 10 August, 1870.
The Deputy Master of the Royal Mint Sydney.
Sydney University Calender, 1883–4. *The Chancellor.*

TOULOUSE :—Mémoires de l'Académie des Sciences, Inscriptions et Belles-Lettres, de Toulouse—
8 Serie. Tome IV. Semestre 1. 1882.
,, ,, ,, ,, 2. 1883. *The Academy.*

TRURO :—The Mineralogical Magazine and Journal of the Mineralogical Society of Great Britain and Ireland—
Vol. V. Nos. 23 and 24.
List of Members, Feb. 1883. *The Society.*

VIENNA :—Anthropologische Gesellschaft—
Mittheilungen. Band XII. Heft 2, 3, 4. 1882. *The Society.*
Kaiserliche Akademie der Wissenschaften—
Register zu den Baenden 81 bis 85 der Sitzungsberichte der Math-Naturw. Classe. Band 10.
Sitzungsberichte—
Abthlg. 1 Band LXXXV. Heft 1–5. 1882.
·2 ,, ,, ,, 3–5. ,,
2 ,, LXXXVI. ,, 1 ,,
3 ,, LXXXV. ,, 1–5. ,,
3 ,, LXXXVI. ,, 1, 2. ,,
The Imperial Academy of Sciences.

VIENNA—*continued.*

K. K. Central-Anstalt für Meterologie und Erdmagnetismus—
Jahrbücher. Band XVI. 1879.
,, ,, XVIII. Erster Theil. 1881.
Imperial Royal Central Institute of Meteorology and Terrestrial Magnetism.

K. K. Geographische Gesellschaft—
Mittheilungen. Band XXIV. (N.F. XIV.) 1881.
The Society.

K. K. Geologischen Reichsanstalt—
Jahrbuch. Band XXXII. Nos. 2–4. 1882.
,, ,, XXXIII. ,, 1-3. 1883.
Verhandlungen. Nos. 8–18. 1882.
,, ,, 1–9. 1883.
Imperial Royal Geological "Reichsanstalt."

K. K. Zoologisch-botanische Gesellschaft in Wien Offenes Schreiben als Antwort auf Herrn Baron Osten-Sacken's "Critical Review," meiner Arbeit über die notacanthen von Prof. Dr. Friedrich Brauer. 1883.
Verhandlungen Band XXXII. 1882.
Imp. Roy. Zoological-Botanical Society.

Österreichische Gesellschaft für Meteorologie.
Zeitschrift. Band XVII. Dec. 1882.
,, ,, XVIII. Jan. to Dec. 1883.
Indexe zu Band XV., XVI., und XVII.
The Austrian Society of Meteorology.

WASHINGTON :—American Medical Association—
Journal, Vol. I. Nos. 1 to 18 inclusive, 1883.
Transactions, Vol. XXXII., 1881. *The Association.*

Chief of Engineers (U.S. Army.)—
Annual Report. Parts I, II, and III, 1881.
,, ,, ,, I, II, and III, 1882.
Fortifications of To-day. (Board of Engineers, 1883.)
Practice in Europe with heavy Rifled Guns. (Professional Papers, No. 25.)
U.S. Geographical Surveys West of the 100th Meridian.
Geology. Vol. III, Supplement, 1881. *The Chief of Engineers.*

Chief Signal Officer (U.S. Army.)—
Professional Papers of the Signal Service, Nos. 2, 4, 5, 6, 7, 10.
Report of the Chief Signal Officer. 1871.
,, ,, ,, 1880. Parts 1 and 2.
The Chief Signal Officer.

Commissioner of Agriculture.
Report of the Commissioner of Agriculture, 1875.
,, ,, ,, 1877
,, ,, ,, 1880
Special Reports of the Department of Agriculture, Nos, 1, 2, 4 to 8, 10 to 12. 16 to 31, 33 to 40, 42 to 52. *The Commissioner.*

Director of the Mint—
Annual Report of the Director of the Mint, 30th June, 1881.
,, ,, ,, ,, 30th June, 1882.
Production of gold and silver in the United States by H. C. Burchard, 1880
,, ,, 1881
,, ,, 1882
The Director of the Mint.

WASHINGTON—*continued.*

Hydrographic Office—

List of Geographical Positions for the use of Navigators and others, 1883.

List of Charts and Plans published and withdrawn, quarter ending 30 Sept., 1882.

List of Lights of South and East Coasts of Asia and Africa, and the East Indies, No. 3A, 1 Jan., 1883.

Notice to Mariners, Nos. 103, 107 to 115, 118 to 120, 122 to 124, 1882.

" " Index, Nos. 1 to 124, 1882.

" " Nos. 1 to 23, 25 to 35, 37 to 81, 83, 85 to 105, 108 to 161, 1883.

U.S. Hydrographic Notices, Nos. 54 to 58, 60 to 63, 65 to 69, 1882.

" " " 1 to 51, 53 to 62, 1883.

" Publications during the quarter ended 30th June, 1883.

Telegraphic Determination of Longitude in the East Indies, China, and Japan, No. 65[b], 1881–1882.

Charts :—

Cuba South Coast. Approaches to Ports Casilda and Masio, No. 916.

Gonaïves Bay (Haïti, or St. Domingo), No. 922.

How Harbour (Newfoundland), " 424.

Madeira River (South America, Brazil) Sheets I to V., Nos. 893 to 897 inclusive.

North America West Coast of Mexico, Harbour of Altata, No. 921.

" " " " " Manzanilla and Santiago Bays, No. 915

North Pacific Ocean, Anadir Bay, Behring Sea, No. 910.

" " " West Coast of North America, including Vancouvre Island, No. 903.

" " " " " " " " No. 904.

Pacific Ocean, Behring's Sea. Providence and Plover Bays, No. 909.

Port Royal and Kingston Harbours, No. 348.

South Pacific Ocean (Lower Part), Sheet I, No. 823.

" " " " " 823[a].

West Coast of Mexico, No. 622.

The United States Hydrographer.

Secretary Department of the Interior—

Compendium of the Tenth Census of the United States. Parts I and II, 1880.

Sixth Annual Report of the U.S. Geological and Geographical Survey of the Territories of Montana, Idaho, Wyoming, and Utah, 1872. (Hayden.) *Department of the Interior.*

Secretary Treasury Department—

Annual Report of the Secretary of the Treasury on the state of the Finances for the year 1881. *Treasury Department.*

Smithsonian Institution—

History of the Smithsonian Exchanges, by G. H. Boehmer.

List of Foreign Correspondents.

Smithsonian Report, 1880. *The Institution.*

Surgeon-General. (U.S. Army.)—

The Medical and Surgical History of the War of the Rebellion. Surgical Volume, Part III, 1883. *The Surgeon-General.*

WASHINGTON—*continued.*
U.S.A. Coast and Geodetic Survey—
Report 1879.
„ 1880.
„ 1881. *The Superintendent.*

U.S. National Museum (Department of the Interior)
Bulletin of the U.S. National Museum, Nos. 2, 12, 13, 14, 15, 16. 20, 21, 24, 26.
The Secretary of the Interior.

WELLINGTON :—Colonial Museum—
Hand-book of New Zealand, with Maps and Plates. (Third edition Revised). 1883.
Seventeenth Annual Report of the Colonial Museum Laboratory, 1881-1882. *The Director.*

New Zealand Institute—
Transactions and Proceedings. Vol. XV. 1882. *The Institute.*

ZAGREB (Agram. Crotia) :—
Viestnik hrvatskoga Arkeologickoga Druztva.
Godina III. Broj. 3.
„ IV. „ 4.
„ V. „ 1, 2, 3. *The Society.*

MISCELLANEOUS.

(Names of Donors are in Italics.)

Archives of Dermatology. Vol. VII. No. 1. January, 1881.
„ „ Laryngology. „ II. „ 1. „ „
Prof Liversidge, F.R.S.

Beilby, J. Wood.
"Eureka." An Elucidation of Mysteries in Nature—The Problems of Science. *The Author.*

Bernays, Lewis A., F.L.S., F.R.G.S.
Cultural Industries for Queensland. *The Author.*

Brazier, J., C.M.G.S., &c,
Description of a New Bulimus from New Caledonia.
Habitat of "Cypræa citrina" of Gray.
Helix Pulchella and H. Cellaria of Mueller found in Australia; with Notes on their distribution.
List of Cypræa found in Moreton Bay, Queensland.
List of Cypræidæ found on the Victorian Coast, collected by Mr. J. F. Bailey.
List of Marine Shells collected on Fitzroy Island, North Coast of Australia; with Notes on their Geographical Range.
List of Species of Porcellana or Cypræa found in Moreton Bay, Queensland.
Note on a specimen of malformed Cypræa.
Remarks on some Fluviatile Shells of New South Wales.
Remarks on some recently re-described Australian Shells.
Synonymy of and Remarks upon two Australian species of Melania.
The Author.

Compte-Rendu des Séances de la Commission Internationale de Nomenclature Géologique et du Comité de la Carte Géologique de l'Europe, tenues à Zurich en Août, 1883. *Prof. Liversidge, F.R.S.*

Etheridge, R., junr., F.G.S.
The Palæozoic Conchology of Scotland. *The Author.*

Fossils obtained from a locality near Carroll. Drawings of (4 sheets.)
D. A. Porter.

Haast, Julius Von, C.M.G., Ph. D., F.R.S. :—
Humanism and Realism in their Relations to Higher Education.
Progress of Geology.
The Author.

Handbook of W. Howard Smith & Sons Line of Intercolonial Steamers.
W. Howard Smith & Sons.

Lamb, H., M.A. :—
On the Oscillations of a Viscous Spheroid.
On the Vibrations of an Elastic Sphere.
On the Vibrations of a Spherical Shell.
The Basis of Statics. *The Author.*

Lancet, Vols. 1 & 2. *Dr. L. Gordon Davidson.*

Lemire, Charles :—
La Colonisation Française en Nouvelle-Calédonie et dépendances.
A. F. Ratte, F.L.S.

L'Esplorazione Rassegna Geografica Quindicinale, Anno I. Vol. I. Fasc. 1 & 2.
Ufficio di Direzione Amministrazione dell' Esplorazione. Napoli.

MacPherson, Rev P., A.M. :—
The Religion of the Aborigines of Australia. A Lecture.
The Author.

Montreal, City of, and its Environs, Hand-book for.
Montreal Horticultnral Society. Seventh Report for 1881.
Montreal Winter Carnival, 1883. *Major L. A. Huguet-Latour M.A.*

Meonen, Leo :—
Australian Wines. *The Author*

Mueller, Baron F. von, K.C.M.G., F.R.S., &c. :—
On a new Acanthaceous Plant from Arnheim Land, North Australia.
Prof. R. Tate, F.G.S., F.L.S.

Mueller, Baron F. von., and Prof. R. Tate :—
On a new Dilleniaceous Plant from Arnheim Land, North Australia.
On a New Rhamnaceous Plant from South Australia.
Prof. R. Tate, F.G.S., F.L.S.

Pollitzer, S., C.E. :—
A Study about the River Murray. *The Author.*

Quebec Carnival, 1883. *Major L. A. Huguet-Latour, M.A.*

Ralph Thos. Sherman, M.R.C.S.E. :—
Micro-Chemical Experiments and Observations on the Structure of Human Blood. *The Author.*

Rossiter, Richard C. :—
List of the Cypræidae found on the Coast of New Caledonia and Loyalty Islands. *J. Brazier, C.M.Z.S.*

Roth, Hy., Ling. F.S.S., F.M.S. :—
Agriculture and Peasantry of Eastern Russia.
The Sugar Industry in Queensland. *The Author.*

Royer, Mme. Clémence :—
Attraction et Gravitation d'après Newton. Paris. 1883.
The Authoress.

Shellshear, Walter, Assoc. M.I.C.E. :—
Light Railways. (Sept. 1883.) *The Author.*

Sir Isaac Newton's Principia. Glasgow. 1871. *Hans Frandsen Madsen.*

Smyth, C. Piazzi :—
Madeira Spectroscopic. 1881-2. *The Author.*

Stirling, James, F.L.S. :—
On the Caves perforating Marble Deposits, Limestone Creek.
The Proteaceæ of the Victorian Alps. *The Author.*
Sydney Morning Herald, from 1 January to 30 June, 1883 (unbound). *Hon. James Norton, M.L.C.*

Tate Professor Ralph, F.G.S., F.L.S.
Additions to the Flora of South Australia.
Diagnosès of New Species of Miocene Fossils from South Australia.
Descriptions of some New Species of Squilla from South Australia.
Notes on the Tertiary Strata beneath Adelaide.
On a Winter-Flowering state of Hypoxis, J. Hooker, and on the differential characters of that species.
The Land and Freshwater Molluscs of Tropical South Australia. *The Author,*

Tate, Professor R., F.G.S., &c., and G. Brazier, C.M.Z.S.
Check List of the Fresh-water Shells of Australia. *J. Brazier, C.M.Z.S.*

Therapeutic Gazette, October, November, December, 1882. *Professor Liversidge, F.R.S.*

Toro, José do Amaral B. de.
A Italia e o Papado. *The Author.*

Waters, Arthur W., F.G.S.
Fossil Chilostomatous Bryozoa from Muddy Creek, Victoria.
Observations made in St. Moritz in the winter 1882-83. *The Author.*

Watts H.
Foraminifera of Victoria. *The Author.*

Wesslau O. E. :—
Free Trade and Protection. *The Author.*

White, Rev. J. S., M,A., L.L.D. :—
Lecture on Anglo-Israelism. 12 December, 1882.
Lecture on Education. No date.
Lectures on Education, National, Secular, Compulsory, and Free. 9 November, 1874, and 5 January, 1875.
Lecture on the Eastern Question, Nos. 1 and 2. 10 May, 1877.
Lecture on Free Trade. 13 April, 1882. *The Author.*

Winter and Summer Sports of Canada, Gold and Silver Jewellery representing the *Major L. A. Huguet-Latour, M.A.*

Woods, Rev. J. E. Tenison, F.G.S., F.L.S. :—
The Coal Resources of Queensland. *The Author.*

Periodicals purchased in 1883.

American Monthly Microscopical Journal.
American Journal of Science and Art.
Analyst.
Annales des Chimie et Physique.
Annales des Mines.
Annals of Natural History.
Art Journal.
Astronomische Nachrichten.
Athenæum.
Botanical Journal (Trimen).
Chemical News.

Comptes Rendus.
Curtis' Botanical Magizine.
Dingler's Polytechnisches Journal.
Engineer.
English Mechanic.
Fresenius' Zeitschrift für Analytische Chemie.
Geological Magazine.
Journal and Transactions of the Phographic Society.
Journal de Médecine.
Journal of Anatomy and Physiology.
Journal of Science.
Journal of the Chemical Society.
Journal of the Society of Arts.
Knowledge.
Lancet,
L'Art.
Medical Record of New York.
Mining Journal.
Nature.
New Zealand Journal of Science.
Notes and Queries.
Petermann's Mittheilungen.
Philadelphia Medical Times.
Philosophical Magazine.
Portfolio.
Proceedings of the Geologists' Association.
Quarterly Journal of the Geological Society.
Quarterly Journal of Microscopical Science.
Science Gossip.
Scientific American.
Telegraphic Journal and Electrical Review.
Zoologist.

BOOKS PURCHASED IN 1883.

Anthropological Institute of Great Britain and Ireland Journal. Vols. 1-7, 1871-1877. 7 Vols.
Anthropological Review. Vols. 1-8, 1863-70. 8 Vols.
Anthropological Society. Memoirs. 1863-69. 9 Vols.
Astronomical Register. Vol. 20, 1882.
Athenæum. January-June, 1877.
Biedermann's Technisch-Chemisches Jahrbuch, 1881-1882.
British Association Report, 1882. (Southampton).
Darwin's (Charles, M.D., &c.,) Fertilisation of Orchids.
,, ,, ,, Forms of Flowers.
,, ,, ,, Movements of Plants.
,, ,, ,, Vegetable Mould and Earthworms.
Dassenbacher Schematismus der Osterreichischen Mittelschulen, 1882-3.
Dictionary of Commerce and Commercial Navigation (M'Culloch), 1882.
Encyclopædia Britannica, Vols. XV, XVI. 2 Vols.
Geological Society of Dublin, Journal, Vols. 1-14, 1838-1877. 14 Vols.
Georgii Agricolae. Froben. Basileae MDXLVI.
Kent's Manual of Infusoria. 3 vols.
Literary and Scientific Society of Liverpool. Proceedings. 1844—1876. 14 vols.
Lock: Gold; its Occurrence and Extraction.
Medico-Chirurgical Transactions. Vol. LXV, 1882.
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Report of the Scientific Results of the Exploring Voyage of H.M.S. "Challenger," 1873—76. Zoology. Vols. VI and VII.
Royal Agricultural Society of England. Journal, Vol. XVIII, s.s. 1882.
Royal Geographical Society's Journal, 1830—1880. 55 vols.
Science Gossip. Vols. I—XII. 12 vols.
Telegraphic Engineers, Journal of. Vols. I—X. 1872—1881.
Telegraphic Journal. Vols. I—VI. 1872—1878.
Text-Book of Geology, by Archibald Geikie, LL.D., F.R.S. 1882.
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189. „ *Royal Botanic Garden. No. 1.
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191. „ *Royal Physical Society. No. 1.
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196. **Adelaide.**—*Government Botanist. No. 1.
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ITALY.

216. **Bologna.**—Accademia delle Scienze dell' Istituto di Bologna. No. 1.
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265. „ *Editor, *Science*.
266. „ *Cambridge Entomological Club. No. 1.
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274. **New York.**—*American Chemical Society. No. 1.
275. „ *American Geographical Society. No. 1.
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278. **Philadelphia.**—*Academy of Natural Science. No. 1.
279. „ *American Entomological Society. No. 1.
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281. „ *Franklin Institute. No. 1.
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287. **Washington.**—*American Medical Association, Pennsylvania Avenue. No. 1.
288. „ *Bureau of Education (Department of the Interior). No. 1.
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305. „ *U. States National Museum (Department of the Interior). No. 1.
306. „ United States Patent Office. No. 1.
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Number of	Publications sent to	Great Britain	... 83
„	„	India and the Colonies	... 48
„	„	America	... 50
„	„	Europe	... 121
„	„	Editors of Periodicals	... 16
„	„	Asia, &c.	... 2
		Total ...	... 320

The Society's House, Sydney,
November 21st, 1883.

A. LIVERSIDGE, } Hon. Secretaries.
A. LEIBIUS, }

PROCEEDINGS OF THE SECTIONS.

(IN ABSTRACT.)

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MICROSCOPICAL SECTION.

Preliminary Meeting, held 9th APRIL, 1883.

Dr. WRIGHT was voted to the Chair.

IT was decided to hold the meetings of the Section on the evenings of the second Monday in each month. The following gentlemen were elected office-bearers for the ensuing session:—Chairman: Mr. G. D. HIRST. Secretary: Mr. F. B. KYNGDON. Committee: Dr. MORRIS, Mr. P. R. PEDLEY, Mr. H. O. WALKER, and Dr. WRIGHT.

14 MAY, 1883.

Mr. G. D. HIRST in the Chair.

A letter, accompanied with a donation of four slides, was received through the Rev. James Jefferis, from Prof. Leipner, of Clifton, England, detailing his method of mounting Polyzoa with their tentacles expanded; and, in the discussion that ensued, Mr. Pedley advocated the addition of 1–3 per cent. of ordinary soda-water or water charged with carbonic acid gas, for the purpose of stupifying active forms of aquatic life.

Mr. KYNGDON exhibited a gathering of pond life from the Waterloo marshes.

Dr. WRIGHT showed six slides of Pathogenous Bacteria.

Mr. PEDLEY, the fungus found in decayed tooth structure, *Leptothrix Bucalis.*

An interesting discussion on the felting properties of wool ensued.

Mr. KYNGDON showed Zeiss' latest homogeneous immersion objectives, viz.: $\frac{1}{8}''$ $\frac{1}{12}''$ $\frac{1}{18}''$.

11 JUNE, 1883.

Mr. G. D. HIRST in the Chair.

A paper was read by the Chairman entitled "What is plus or minus 180° Air-angle and Numerical Aperture?"

Dr. WRIGHT exhibited, on behalf of Mr. Thomas Francis, C.E., several beautifully executed photographs of microscopical objects, also, instantaneous exposures taken in the 1,500th part of a second.

Dr. RALPH, President of the Microscopical Society of Victoria, called attention to the supposed presence of a *Bacillus* in the living plant cells of a *Vallisneria* growing in a pond in the Botanic Gardens.

Messrs. HIRST, PEDLEY, and KYNGDON exhibited *Plumatella repens*, *Vorticellæ*, and several other living fresh-water organisms.

Mr. HEWETT showed his arrangement of the Micro-polariscope, whereby the rings and crosses produced by convergent light upon calc spar (a uni-axial crystal), nitre and quartz (bin-axial crystals) were beautifully displayed.

One of Prof. Huxley's Dissecting Microscopes, made by Parkes of Birmingham, and containing many novel features, was exhibited.

9 JULY, 1883.

Mr. G. D. HIRST in the Chair.

A list of the Foraminifera of Victoria was presented by the author, Mr. WATTS, of Collingwood, Victoria.

Mr. HEWETT exhibited his adaptation of the Micro-polariscope to display "circular polarisation."

Dr. MORRIS showed Messrs. Swift's arrangement for the same purpose; also Swift's new combination of the Petrological and University stands,—an admirably designed instrument for public analysts, geologists, and students.

Dr. MORRIS exhibited slides of butter, and oleo-margarine, and explained the manufacture of artificial butter and its distinguishing test under the micro-polariscope.

Mr. HIRST shewed some beautiful drawings he had made from the microscope, of several forms of fresh-water organisms, and living specimens of the same class were displayed beneath his own and other microscopes.

13 AUGUST, 1883.

Mr. G. D. HIRST in the Chair.

Mr. WHITELEGGE read a paper entitled "Notes on Pond Life," descriptive of the best methods of searching for, collecting and preserving alive for observation the various forms of minute animal life to be met with in fresh water, and he gave a list of his findings in the Waterloo marshes.

Mr. WALKER exhibited two mounted slides of a winged and wingless scale insect found on gum-leaves.

Mr. WHITELEGGE showed two tubes of *Volvox* preserved for fourteen months with osmic acid.

Mr. HIRST called attention to the increase of angular aperture obtained by screwing the collar of Zeiss' $\frac{1}{8}$ water immersion objective to its utmost and using 1 of glycerine to 2 of water for the immersion fluid.

Mr. Trebeck sought information respecting the green colouration of some high class bricks, and the meeting agreed that it was not due to organic matter, but some inorganic salt.

Dr. Wright exhibited Stearns arrangement of Swan's incandescent Electric Lamp for microscopical purposes, and a marked improvement in illumination was observed.

Messrs. Whitelegge and Kyngdon showed a new species of *Floscularia*, also *Volvox globata* from Waterloo marshes, and Mr. Fraser, a fresh-water gathering from Bondi.

10 SEPTEMBER, 1883.

Mr. G. D. Hirst, in the Chair.

Dr. Morris asked for information with regard to a fungus attacking the roots of vines in the Camden district.

Mr. Hirst exhibited a new species of diatom, *Surirella*, from New Caledonia; Mr. Pedley, an injected section of the cerebellum of a kitten, prepared by himself; Dr. Morris, Tolles' new $\frac{1}{8}$ homogeneous objective on *Amphipleura pellucida* × 300 diameters, also Powell and Lealand's large stand microscope with their new wide-angled condenser, also Nelson's new kerosene lamp, with flat glass front to the metal chimney; Mr. Kyngdon, Zeiss' $\frac{1}{18}$ hom. imn. on a podura scale; Mr. Sharpe, Swift's best Challenge Monocular Microscope, with Powell and Lealand's new $\frac{1}{12}$ homogeneous objective of 116° Balsam angle; Mr. P. T. Owen, a visitor, showed slides of Foraminifera from Wollongong; and Mr. Brindley, pink coral from the South Sea Islands.

8 OCTOBER, 1883.

Mr. G. D. Hirst in the Chair.

Mr. Hy. Watts, of Collingwood, Victoria, wrote, requesting co-operation in microscopical matters, by assisting to form an arrangement based upon the successful working of the English "Postal Microscopical Society."

The 1″ and ½″ Tolles' orthoscopic eye-pieces recently purchased for the Society's Microscope, were placed on the table.

Mr. Whitelegge exhibited a new species of rotifer, *Lacinularia socialis*, found in a Randwick pond, also two species of new and rare Floscularia, and a fresh-water sponge hitherto only found in Queensland; Mr. Pedley, Moller's Test Diatoms, mounted in monobromide of naphthaline, with Siebert's $\frac{1}{12}$ homogeneous immersion objective; Dr. Wright, Tolles' new $\frac{1}{25}$ homogeneous immersion objective, with podura scale and test diatoms; Mr. Kyngdon, simple Microtomes or section-cutting machines.

12 NOVEMBER, 1883.

Mr. P. R. PEDLEY in the Chair.

Mr. HY. WATTS' first box of twenty-four slides, and his letter relating to the plan of working the Postal Microscopical arrangement were placed before the meeting.

Dr. WRIGHT exhibited, for Mr. Matthews of Adelong, the first 26 numbers of Cole's "Studies in Microscopical Science;" Mr. WHITELEGGE, living specimens of the large water-flea, *Daphnia cheronata*; Dr. WRIGHT, the Bacteria of hay infusion, with Tolles' new $\frac{1}{25}$ homo. imm. objective, whereby some indications of the internal structure of these exceedingly minute organisms were made out; Mr. WALKER, the male mosquito, mounted by himself.

10 DECEMBER, 1883.

Mr. G. D. HIRST in the Chair.

Dr. MORRIS presented to the Society seven slides of *Amphipleura pellucida*, mounted in media of increasing diffractive properties, so that this donation forms a complete series of tests for the highest objectives. These *A..pellucida* were collected by him in a rock pool in Stirlingshire, Scotland; Mr. HIRST, infusorial earth from near the Warrambungle Mountains, Dubbo, containing the fossil diatom *Melosira*, also two slides of double-stained vegetable sections, beautifully mounted by Mr. Hy. Sharpe of Adelong; Dr. WRIGHT, Bacteria of hay infusion, stained with methyline blue to show the endoplasm by using Tolles' $\frac{1}{25}$ homo. The cell contents were rendered plainly visible.

MEDICAL SECTION.

The Medical Section of the Royal Society held a preliminary meeting for the election of officers, April 13, 1883.

The following were elected:—Chairman: Dr. F. NORTON MANNING. Secretaries: Dr. H. N. MACLAURIN, Mr. THOMAS EVANS. Committee: Dr. MACKELLAR, Dr. BEDFORD, Dr. CRAIG DIXSON, Dr. EWAN, old members; Dr. SCHUTTE, Dr. HURST, new members.

Seven general meetings were held during the session, on the dates appointed by the Council of the Society. The December meeting was not held, as the date fixed for it came too close to the Christmas holidays.

The meetings were more largely attended than in any former session, and many subjects of great professional interest were discussed by the members present.

Numerous cases were reported, and pathological specimens exhibited.

Among the papers read may be mentioned the following:—By the CHAIRMAN, on Lunacy Certificates under the recent Act, and on hallucinations arising from the use of salicin; by Dr. MACKELLAR, on Federal Quarantine; by Dr. CHAMBERS, on Placenta Praevia, and on Ovarian Disease; by Mr. EVANS, on Jequirity; and a valuable series of contributions on Typhoid Fever by Messrs. MUSKETT, BYRNE, BEATTIE, and SHEWEN.

On the whole the past session has been the most successful in the annals of the Section.

F. NORTON MANNING, Chairman.

H. N. MACLAURIN,
THOMAS EVANS, } Secretaries.

Sydney, February, 1883.

Medical Certificates of Insanity.

By FREDERIC NORTON MANNING, M.D., Inspector-General of the Insane, New South Wales.

[Read before the Medical Section of the Royal Society of N.S.W., 15 June, 1883.]

By the Lunacy Act which came into operation in January, 1879, two certificates by legally qualified medical practitioners to the effect that the individual "is insane, and a proper person to be taken charge of and detained under care and treatment" are necessary before any person can be admitted into a hospital or licensed house for the insane in this Colony, and each of these certificates must set forth, 1st, the facts indicating insanity observed by the practitioner signing the certificate, and 2nd, the facts communicated to him by others. Prior to this date such certificates were not required by law, but were always insisted on by the Judges of the Supreme Court in any cases coming within their jurisdiction, and, for some years before the passing of the Lunacy Act above referred to, were furnished by direction of the Colonial Secretary, at my request, in all cases sent from Government institutions, and in a large number of those committed to hospitals by Police Magistrates and Justices. All the requirements of the law were, however, met by two medical practitioners stating on oath that they considered the person to be a dangerous lunatic. It was not necessary that the grounds on which such opinion was based should be stated.

Though full, complete, and in most respects, excellent certificates have been furnished by the majority of medical practitioners from the inception of the Act, its requirements, which are not greater than those of the statutes in force in Great Britain and Ireland, France, America, and other countries, were regarded by some medical practitioners as excessive, and the facts stated in their certificates were so meagre and unsatisfactory that in not a few instances it became my duty to point out the necessity for fuller and more complete statements.

During the last two years the importance of the certificates and the necessity for filling them in fully have been much more generally recognized, but a number of those furnished, though affording evidence of the insanity of the patient, and being so far correct as to make their rejection impossible, are still meagre and unsatisfactory documents, giving little assistance to the medical officers of the hospitals into which the patients are admitted, and calculated to add little to the reputation of the writers if they

should by chance be produced as evidence in a Law Court; whilst a few have been so defective that they could not be received. Copies of twelve of these received within the last fifteen months (the names of the medical practitioners being omitted) I now place on the table, for your perusal.

I desire to say at once that in no case admitted into institutions for the insane during the last or any previous year was there reason to doubt but that mental symptoms sufficient to justify the temporary confinement and medical treatment of the patient existed at the time the certificates were signed. In some rare and exceptional cases I have seen reason to doubt the wisdom of the course taken; but during an official experience, extending now over fourteen years, I have never had reason to think that any medical practitioner, in discharging what has been fitly called "this great social responsibility," acted otherwise than with honest intent, or than as in his judgment seemed best for the patient and those around him.

The importance of these certificates as official documents, the information they afford, if fully and carefully prepared, to the medical officers of hospitals and licensed houses, their liability to be produced in Law Courts, and the fact that each one is freighted with the welfare, present and future, of the person concerning whom it is given, make their proper preparation a weighty question, and I think that I may not occupy your time unprofitably by entering somewhat fully into it.

The first question which arises is the policy of limiting the signature of these certificates to medical men occupying official positions. Our Act—I venture to think wisely—makes no such limitation, but a Bill which has been on several occasions before the Imperial Parliament proposes that the signature of these documents should rest mainly, if not entirely, with experts holding an official status, and being virtually Coroners in Lunacy, or with medical men holding certain official positions. There is doubtless something to be said for this view. There was much more to be said for it some years ago than there is now, since the large majority of medical men were empowered to practise their profession without attending a single lecture on insanity, without ever entering the wards of a hospital for the insane, and without any examination on the subject of psychological medicine. But this is so no longer. Every medical school teaches psychological medicine as part of its curriculum, and an examination in mental diseases is necessary for the higher degrees in Medicine at most Universities. Those interested in insanity have for years done their utmost to inculcate the doctrine that it is a disease of the brain and not a disorder of the intellect; they have tried to knock down the barriers which have been set up about it, and which have separated it from diseases of other organs, and they have done their utmost to make

asylums hospitals for the treatment of the sick and the education of the student, and not mere places for the safe keeping of the inmates. To restrict the signature of certificates to an official class is to take diseases of the brain out of the ordinary category of human ailments, and, as it seems to me, to move altogether in a backward direction.

A large number of lunacy certificates—those dealing with persons wandering at large, and not under proper care and control—must, as a matter of necessity, be signed by practitioners holding official positions as Surgeons to the Police or Gaols, and Government Medical Officers for the district; and this is especially the case in this Colony, where a considerable part of the population have no settled homes. As a matter of fact, out of the 944 medical certificates which passed through my hand in 1882, considerably more than one half were signed by officials; but the ordinary medical attendant, where there is one, is most undoubtedly the fittest person to sign a certificate of insanity. Parents and friends naturally ask his aid, and shrink from the exposure of the patient to medical men unknown to him, when they have already been obliged to seek the opinion of those in whose judgment and honor they confide, and they call in a second medical man in consultation, as they would in any other serious malady. The ordinary medical attendant, from his previous knowledge of the patient, can distinguish and appreciate any change in his demeanour, habits, and conversation, as compared with previous conditions, far better than any stranger who may be called in, and he is more likely to be aware of the patient's environment—a question often of the utmost importance in testing his sanity. A knowledge of the circumstances, and even of the family history of the patient, is in many cases a necessity in determining the mental condition; and on this point I would refer you to an excellent article by Dr. Charles Mercier, in the Journal of Mental Science for Oct., 1882, on the data of alienism. To put this in its simplest form, he says "if a man states that he is worth a large sum of money, and talks of his mansions and gardens, we cannot regard this as evidence of insanity until we have discovered whether or no he is in actual possession of these things—in other words, until we have investigated his environment. If a man states that he has had boiled beef for dinner every day for seven years, we may consider this statement *prima facie* evidence of insanity; but if we find that, under a stupid military or official system, it is actually true that he has been so dieted, we learn the necessity of taking account of our patient's environment before concluding that he is insane." The importance of this is, I am confident, somewhat overlooked, and certificates of insanity are sometimes given founded on a basis true enough as regards the majority of mankind, but false as regards the particular

instance. I have occasionally, in cases of undoubted insanity, discovered that some of the statements made by the patients, which were regarded as delusions, and relied on in the certificates as proofs of insanity, were absolute facts, and this has been especially the case with regard to the domestic relations of the patient, a matter in which you as medical men are aware truth is often stranger than fiction. The domestic relations of the patient should, as a matter of course, be more within the cognizance of the ordinary medical attendant than of a stranger.

One of the chief reasons given for relegating the signature of medical certificates to officials is to prevent the sequestration of persons who are sane, for improper purposes. A short account of the law as it now stands in this Colony may serve to show how difficult—nay, almost impossible—it would be to secure such collusion as would effect this.

Patients can be admitted into institutions for the insane under two processes. The first (section 6 of the Act) is by an "order" made by two Justices of the Peace, given after personal examination of the patient and after the signature of certificates by two medical practitioners, and the production of such other evidence as they may deem needful. Under this process four persons, at least, must either be in a conspiracy, or there must be gross neglect on the part of some of them to allow of wrong-doing by others.

The second (section 8 of the Act) is by "request" on the part of a relative, friend, or guardian. Such "request" must be accompanied by two medical certificates, and the signature to it must be made before a Justice of the Peace or a clergyman. It is not, like the "order" above mentioned, a mandatory document. The superintendent of any hospital or licensed house to which it is addressed can decline to receive the patient, and should do so if he is not convinced of the insanity. Under this process then there is again the safeguard of four independent persons, two medical practitioners, a relative or friend (who signs the request before a Justice or clergyman), and the superintendent of the hospital or licensed house. But these are not all the precautions. The superintendent of every private institution or licensed house must, within twenty-four hours of the admission of every patient, and the superintendent of every public institution or hospital must, within seven days of the admission, send a notice of such admission, together with copies of all the papers, including the medical certificates received with the patient, to the Colonial Secretary, and these papers by departmental arrangement pass through the Inspector-General's hands, for examination, on their way to the Colonial Secretary's Office; and in the case of every patient admitted into either a hospital or licensed house, a special certificate signed by the medical superintendent, and setting forth his deliberate opinion as to the patient's mental condition,

must be forwarded to the Colonial Secretary through the Inspector-General, within seven days of the admission. As further safeguards against collusion or fraud (by section 10 of the Act), the two medical certificates in any one case cannot be signed by father and son, brothers, partners, or practitioner and his assistant, and no certificate for the reception of a patient into any institution can be signed by the superintendent or medical officer of such institution, or by his father, son, brother, partner, or assistant and any one interested pecuniarily in such institution.

There are penalties (section 11) against signing certificates without special examination of the patient, and any one wilfully and falsely certifying that any person is insane, knowing him not to be insane, is guilty of a misdemeanour. With all these precautions I think you will agree with me that the improper sequestration of any person is a matter of extreme improbability, and is indeed almost impossible, and that the reasons given for the employment of special officials in the signature of certificates have no real weight.

The statute very properly requires that these documents should be drawn up in a definite and particular form. These formal requirements are as follows:—1st. The date of the examination. 2nd. The place where it is held. 3rd. That it has been made separately from any other medical practitioner. 4th. The name, residence, and occupation of the patient. 5th. That such patient is insane or an idiot.

On examining the printed form of certificate, you will see that it is necessary to state not only that the person is insane or an idiot, but *that he is a proper person to be taken charge of and detained under care and treatment*, and the grounds on which this twofold opinion has been formed are then to be set forth in detail.

It is not sufficient to certify that the person is insane—he must be insane and something more. Insanity in its chronic and harmless form is not sufficient to justify a certificate for admission into a hospital or licensed house. One meets every day persons who are insane more or less, who have strange fancies and absolute delusions, or who display extreme weakness of intellect, but who yet are harmless and often lead seemly lives and do useful work. Believers in astrology, fortune-telling, palmistry, and magic still exist, and modern superstitions of every kind may be reckoned by hundreds. The belief in witches and witchcraft is possibly dead, but civilization has even more fetishes than savagedom, and there is no end to the strange beliefs and delusions to which persons are subject.

It is an important question what makes an insane person a proper person to be taken charge of and detained under care and treatment, and I think the answer is, briefly, that he is either in such a stage or condition of the malady that he is likely to be

benefited by care and treatment in a special institution, or is dangerous to himself or others, or is liable or likely to commit an offence against the law. There is one condition which I think may be added to these, and that is where the person is a constant trouble or nuisance to others. Such cases are not uncommon, and the persons who are the sufferers from the trouble and nuisance are, as a rule, those in authority or occupying some prominent position. The following is briefly a case illustrating this:—In the excitement which followed the destruction of St. Mary's Cathedral by fire—you are aware how all popular excitement seizes on or finds its echo in the brains of weak-minded folk—a man conceived the insane notion that the then Governor of the Colony was the incendiary, and by letter-writing, haunting Government House, and other follies, became such a nuisance that it was necessary to place him in Gladesville. When this particular Governor left the Colony I felt justified in discharging this patient, who was quiet and harmless, though the insane idea remained and probably remains to this day.

In the certificates such facts should be stated as afford evidence not of insanity only, but of such insanity as renders detention, care, and treatment advisable or necessary. This is, I think, an important point.

We now come to the gist, or, as a writer* on this subject fitly calls it, the "marrow" of the medical certificate, what the medical practitioner affirms to be facts indicating insanity observed by himself. On this it is that the validity of the certificate really depends, since the Lunacy Act, section 9, distinctly sets forth that no person shall be received into any hospital or licensed house under any certificate which purports to be founded only on facts communicated by others, and it is here that so many certificates are defective or unsatisfactory.

It seems at first sight one of the easiest possible things to fill in this part of the certificate, but it really requires some thought, some practice, and some method, to state in half-a-dozen lines or sentences the facts which indicate beyond a doubt that the patient is insane—the symptoms of insanity which the law demands as an essential part of the medical certificate.

The chief irregularities and imperfections met with in medical certificates come under one of five headings:—

1st. Opinions are stated instead of symptoms, signs, or facts. The patient is described as "imbecile," a "confirmed lunatic," "suffering from puerperal mania," a "confirmed melancholia," statements which are no doubt true, but which have no value as evidence. What is really required is the grounds on which these opinions are based.

* Dr. Bucknill on Medical Certificates of Insanity. Journal of Mental Science, vol. vi.

2nd. General statements are made. The patient is described as "suffering from great excitement," "reasoning illogically," "having various hallucinations and delusions," "subject to habitual intemperance," "having the leading symptoms of *delirium tremens*," or it is said that his actions indicate insanity and that he has delusions as to his property. The English Commissioners in Lunacy have, it appears to me rightly, held that the statement of the existence of delusions or hallucinations is insufficient unless the nature of these is described, and all vague and general statements are clearly inadmissible. "Great excitement," "habitual intemperance," and "reasoning illogically" are no proof of insanity.

3rd. Irrelevant statements. Under this head come all statements as to the cause of the insanity, comments on or explanation of the symptoms, mention of the shape of the head or neurotic constitution of the patient, and, under this heading would come also the self-complacent statement in a medical certificate received by Dr. Brushfield—"the patient called me a fool."

4th. Hearsay evidence is given under headings of facts observed by the medical practitioner himself. For instance "has not slept for several nights," "has eaten nothing for four days," facts probably, but facts which could not possibly have come under the personal observation of the writer.

5th. Defect of form, or faulty and incomplete way of putting valuable and convincing information, and this is the way in which the majority of certificates are open to criticism. The facts mentioned are good, but they are badly, vaguely, or inconclusively put. Let me illustrate this by a few examples. In a certificate mentioned by Dr. Bucknill "he puts stones in his pocket and will not talk" were the facts mentioned in regard to an idiot boy, and in this form were clearly insufficient, but "he picks up stones and puts them in his pocket as if he attached great value to them, and when questioned he makes no reply and shows no signs of understanding what is said to him" forms a fair certificate. Again—"he has bought a number of rich dresses and states that he has a large house in Sydney and £1,000 a year" may or may not indicate insanity; but put in this way "He has bought a number of rich dresses for which he has no possible use; he believes that he has a large house in Sydney, which is a delusion, and that he has £1,000 a year, whereas he is a day labourer without means," it is good evidence of mental derangement. The words "which is a delusion" or "which I know to be a delusion" should be added in every case in which the insane opinion or statement is not in itself unreasonable. When a man announces that he is an Emperor, or a Deity, or that devils catch him by the throat, telephones talk to him through the key-holes, or that the birds call him names as he passes through the fields, the

insane opinion is so obvious that no mention of its being a delusion is necessary. Again "He constantly uses violent and obscene language, beats his children, is dirty in habits, and spends a large part of his time in bed" describes a very objectionable, but not necessarily a mad, man; but put as follows the evidence of insanity is satisfactory: "He was formerly correct in language, clean in personal habits, and indulgent to his children; his habits have completely changed, he uses violent and obscene language before his family, beats his children without cause in the most violent manner, refuses to wash himself, and lies in bed under the idea sometimes that he has some fatal disease, which is not the fact, and at others that people are waiting outside his door to do him some injury."

The symptoms or facts indicating insanity should be arranged in the most simple and practical form. A good certificate need not, as a rule, be a long one, and the best classification of these symptoms is that suggested by Dr. Bucknill:—

1st. The appearance of the patient.
2nd. His conduct.
3rd. His conversation. In short, "How he looks, what he does, and what he says."

1st. In the appearance of the patient may be included the facial aspect, which may be meaningless or vacant, melancholic, frightened, or anxious, or wild and excited, according to the mental condition, the attitude and gestures, which are often exceedingly characteristic, and also the dress, which is in many cases very peculiar. The garments brought into Gladesville by some of the patients are of the strangest character. I remember a large cape made entirely of cocks' feathers, and a hat trimmed with a long bullock's tail. Many insane persons have a peculiar fancy for decorating their heads with feathers, and others will wear no covering at all to the head.

2nd. The conduct or demeanour may be childish and silly, moping and apathetic, violent, aggressive, or destructive, or it may evince vanity, pride, or fear. Purposeless destructiveness is one of the surest signs of some forms of mental disturbance. The dull, apathetic manner, and the averted eyes, are distinctive of the insanity of masturbation. A marked change of demeanour, conduct, or habits, is often a sufficient proof of insanity, even if no delusions can be discovered, and an absolute refusal to speak is a not infrequent symptom.

3rd. Speech or conversation. Under this heading come incoherence, inconsequence, excessive volubility, the rapid change of subject—ideation outrunning all power of consecutive expression—obscene and abusive language, delusions, illusions, and hallucinations, as well as the imperfections or total absence of the faculty seen in the idiot, its impairment in dementia, and the slow unwilling utterance of the melancholic.

It is beyond my purpose to enter into any detail concerning these various conditions, but I wish to point out the importance of more frequent mention of hallucinations than is usual in medical certificates. Auditory hallucinations are of very common occurrence and yet are rarely mentioned, and when either these or optical hallucinations are not recognized by the patient as sports of the imagination, they are a most pronounced and dangerous symptom, and lead to violence in a large number of cases.

In addition to the symptom or facts above noted, attention should be directed to—

4th. The condition of the memory.
5th. Change in the higher emotions, and
6th. Other abnormalities.

The following, which I have taken with some alterations from an admirable article on this subject by Dr. Brushfield in the *Lancet* for May, 1880, is suggested as a form for medical certificates, and brings all the essential points under notice:—

Appearance, especially facial aspect, attitude, peculiarities of dress.
Conduct and general demeanour, restlessness, excitement, violence, exaltation, or depression.
Condition of the habits and propensities, especially as to change.
Delusions; if any, describe them.
Hallucinations, do., do.
Coherence or incoherence, volubility, obscenity.
Condition of the memory.
Change in the higher emotions.
Other abnormalities.

The second series of facts in the certificate are those communicated by others, and I may here call attention to the necessity of stating the name or connection with the patient, as relative, nurse, attendant, &c. of the person from whom this information is derived. The marginal note on the certificate runs—"Here state the information and *from whom*." In some cases the value of the information is greatly enhanced and in others is much lessened by the position of the person giving it.

In some cases the second part of the certificate is unnecessary, the facts communicated by others being surplusage in a legal point of view, but in all cases this part of the certificate may afford information of great value and importance to the medical officers of hospitals, and in some cases the facts are of the utmost importance, being the prominent feature of the certificate, and dwarfing altogether those observed by the medical practitioner himself. In some cases of epilepsy the medical practitioner seeing the patient between the paroxysms can testify only to a dull heavy expression and some loss of memory, whilst the friends can give

evidence of frequent or occasional fits, and of dangerous or homicidal violence or extravagant acts at these periods. In some cases of melancholia the medical practitioner can give evidence of a despondent expression, a sullen or distrait manner, and some vague statement as to mental distress (the patient frequently being very reticent in these cases) whilst the friends are cognizant of distinct attempts at suicide, and can give particulars as to the mode in which these attempts were made. There are indeed some cases of suicidal insanity urgently requiring hospital care and precautions, where the patient displays few or any of the physical or intellectual signs of aberration of mind, and can and does conceal such as are ordinarily present when visited by a medical man. In these cases the facts communicated by others are of paramount importance.

It is necessary to be cautious in sifting the testimony as to a patient's actions given by those about him. This testimony is sometimes, to use a legal expression, "tainted." The acts of insanity described by relations or so called friends should not be taken without scrutiny; since, it may be, that they are anxious to be rid of the patient, from some interested motives which are carefully concealed, or merely to save themselves trouble. The evidence of officials in poorhouses and other institutions of like character is liable to exaggeration, and hospital nurses have been known to complain of restless delirium accompanying acute disease in terms not altogether justified by the facts. The outbreaks of passion accompanied by destructive tendencies, and in the case of women by violent hysterical symptoms, well known to all experienced prison officials, are in some cases so magnified by those in charge of troublesome prisoners as to mislead young prison surgeons. The fact that a great many marriages are not made in heaven should never be forgotten. Cases where, owing to family squabbles, husbands and wives call each other mad, must be familiar to most medical men, who are often "asked, for the satisfaction of one of the parties, to pass his dictum on the other."

Under the heading of facts communicated by others, it is not an uncommon thing to find the words "has been in an asylum before." This is very proper and necessary information for the "Statement of particulars" which accompanies every patient to hospital, but is not a fact indicating present insanity, and indeed on the certificate is an altogether irrelevant statement. Whenever it is made, moreover, to the medical man, it behoves him to exercise an even more than usual care in giving a certificate. Let it be once known that a person has been under hospital care, and if he gets drunk, quarrelsome, or excited, he is deemed by those about him as qualified for re-admission.

Before a medical certificate is signed, careful physical as well as mental examination should be made, and I am the more anxious to point out this because when a medical practitioner is

called on hastily to examine a patient, he is often so absorbed by the mental phenomena, especially if these are at all pronounced, that he fails to note the bodily ailments which are present, and which under other circumstances would attract his attention if they were not complained of by the patient. I think no medical practitioner should sign a certificate in a case which he has not had for some time under observation, without using the clinical thermometer and listening to the chest. One of my earliest experiences in charge of a hospital for the insane was the reception of a patient who was suffering only from the delirium of pneumonia, and I have, on at least three occasions, known patients admitted under certificates of insanity when in the early stages of typhoid fever, which may at its onset be mistaken either for the melancholia with stupor of French, or the acute dementia of English writers, or for acute asthenic mania at a later stage. The use of the thermometer will go far to prevent a mistaken diagnosis, for though acute asthenic mania is accompanied by some increase of temperature the rise is not nearly so marked, nor the diurnal range so large as in typhoid.

There is a necessity for physical examination also, to ascertain if the patient is suffering from injury or chronic disease. Cases have ere now been received in institutions for the insane with fractured ribs, fractured pelvis, and even fractured skull, or some serious and fatal ailment, undetected. As another reason for physical examination, I may mention the necessity for ascertaining if the patient may safely be removed, and undertake, what is sometimes, a long and trying journey to hospital.

The existence of physical defect or peculiarity has in some instances led to errors. A "vacant expression of countenance," mentioned in a certificate has been found to be due to deafness; and blindness, malformation, defects in speech, and peculiarities of gesture may mislead unless carefully taken into consideration. You will think that I am taking an altogether unnecessary precaution in pointing out that the certificate must refer to insanity existing at the time it is signed—to present and not past disease—but three certificates have lately passed through my hands in which the whole of the particulars or facts were in the past tense, and in one of them the writer actually erased the word *is* and made his certificate read that the patient *was* insane, at some by-gone period not stated.

In all cases, except those sent to hospital by the order of Justices, the currency of the medical certificate does not extend beyond ten days, and unless the patient is sent to hospital within ten days of the date thereon, fresh certificates are necessary.

In conclusion, it is well that he who signs a certificate should remember that he may have to defend all his "facts" in a Court of Law, and be tried in the crucible of cross-examination. A vision of the

witness-box and its troubles may tend in some instances to care in the preparation of these documents, and the heavy damages obtained not long since against a medical man in a neighbouring colony, may serve as a stimulus in a similar direction in others, but the best reason for the exercise of care and discrimination is the importance of "the professional act which may deprive a man of liberty perhaps for life."*

* Bucknill, Journal of Mental Science, vol. VI.

Federal Quarantine.

By Dr. CHARLES K. MACKELLAR,
Health Officer and Medical Adviser to the Government of New South Wales.

[*Read before the Medical Section of the Royal Society of N.S.W., 20 July, 1883.*]

AT a meeting of the Medical Section of the Royal Society of New South Wales, on 20th July, 1883, at their house, Elizabeth-street, Sydney, Dr. Frederic Norton Manning in the Chair, the following paper on the necessity of a system of Federal Quarantine for the Australasian Colonies was read by Dr. Charles K. Mackellar, Health Officer and Medical Adviser to the Government of New South Wales :—

I have been invited to initiate this evening a discussion upon the whole question of quarantine, and I willingly accede to the request, as I fully recognize the necessity for our arriving at clear and decided views as to what amount of quarantine restriction is and what is not necessary, in order to afford us the greatest amount of security from extraneous epidemic diseases. I propose, in a general and discursive way, to give a short history of quarantine, and to answer in the affirmative the three following questions :—

1st. Is the imposition of quarantine in accordance with the teaching of modern medical science?

2nd. Is it advisable that a rigorous quarantine should be maintained throughout Australia?

3rd. Is it necessary that there should be a mutual agreement between our various Governments on this subject—in fact, a federal quarantine?

During the short period in which I have held an official position in the Health Department of New South Wales, I have been asked so often, with such seeming earnestness, and by such intelligent and thoughtful men, whether quarantine is really necessary, that it appears to me that people, as a rule, have no very clear ideas upon the subject. Nor is this to be wondered at, as it i imposed at comparatively rare intervals, and perhaps not one in thousand of our population has been at any time subject to its influence. Moreover, many commercial writers, and even some medical authors of the greatest repute, especially in those countries

which have very large commercial interests at stake, and at the same time such a geographical position as renders efficacious quarantine in their case impossible, at times decry the beneficial influence to be derived from its imposition.

A short time ago I had placed in my hands by the Government a letter written by Dr. Sedgwick Saunders, the Medical Officer of Health for the city of London, and addressed to the Eastern and Australian Steam Navigation Company, wherein the following sentences occur:—"Respecting the question of quarantine, it is pretty well agreed among American and English sanitarians that the medical inspection of a ship, with a proper supply of detached hospitals, is infinitely preferable to the detention of a number of healthy people for any portion of what may be termed the 'incubation' period. Quarantine is not only utterly useless in small-pox, or diseases of the zymotic class, which have a definite time for their development after exposure to contagion, but it leads to all kinds of deceit and falsehood on the part of those who are interested in clearing the ship, besides inflicting great personal inconvenience upon healthy persons." And further on in the same document a very important statement is made, as follows:—"The most recent authoritative dictum upon this subject is that published in the 'Supplement to the Ninth Annual Report of the Local Government Board, 1879–80, in a paper by Mr. J. Netten Radcliffe, where we find the following:—'Quarantine rests upon the traditions of medicine,—not upon the existing state of medical knowledge in British medical schools as to the diseases to which it is applied. The experience of quarantine in this country has been such as to show its utter futility as a practical measure of precaution against the invasion of a foreign disease, and for some time past it has been seen that such medical reasons as can be pleaded for it are countervailed by medical and social reasons of quite equal force against it. Hence quarantine is now retained on the statute book for the purpose of avoiding certain disabilities to which our shipping would else be subject in countries in which quarantine is held to be an essential element in the prevention of certain spreading diseases.'"

In the face of such a dictum, one cannot wonder at the impatience exhibited by the trading community when one of their vessels is detained. What the medical reasons which countervail the performance of quarantine are I know not, as the way in which we conduct it in this Colony implies a strict adherence to known sanitary laws, such as the segregation of the sick, the disinfection of persons and things, and the thorough cleansing of vessels. The social reasons are apparent to all, but I think that if the commercial reasons had been added the matter would have been clearer still. So far as I can see, the whole of the objections to our quarantine may be summed up in the inconvenience and thraldom

to persons, and the temporary damage to commercial interests. The imposition of quarantine upon a ship not only implies a very serious monetary loss to her owners, but it also entails the arbitrary detention of a number of apparently healthy people—not because of any act of their own, but simply because they have been unfortunate enough to come within the range of virulently infectious disease. It is a sort of imprisonment without a crime; and I have therefore deemed it my duty, while enforcing a rigid examination of persons and vessels likely to endanger the public health, to make the detention of ships as short as is consistent with perfect innocuousness, and the imprisonment of the unfortunate passengers as free of unpleasantness as the circumstances of the case would permit.

I may here give you a brief outline of the method in which we conduct our quarantine at this port. All vessels from places beyond the Colonies are subjected to inspection by the Assistant Health Officer, whether they have clean bills of health or not, unless they have touched at one of the colonial ports *en route* to Sydney; but on the Governor and Executive Council proclaiming that any port or country is affected with infectious disease, a vessel arriving from such country is rigorously examined, notwithstanding her having touched at and received pratique at a colonial port; and, moreover, in her case the examination must be conducted during daylight at the Quarantine Station. If the boarding officer is satisfied that her admission it not likely to endanger the public health, he immediately gives her pratique; but if the sanitary condition is such as to be likely to prejudice the public health, his duty is to detain her until a satisfactory cleansing process is effected; and should she have virulently contagious sickness on board, the passengers and crew are detained for such a period as may be deemed necessary. For instance, on the arrival of a ship at this port with small-pox on board, she is immediately placed in quarantine; all communication with the shore, except through the medium of the quarantine officers, is interdicted; the patients and convalescents are removed to their respective hospitals, and the passengers and crew of the vessel, all of whom have of course necessarily been within the range of infection, are taken on shore, isolated, and detained for twenty-one days, which term our experience in the late epidemic, furnishes some evidence to show may be considered as the limit of the period of incubation of small-pox. The principle which guides us is, that persons who may reasonably be suspected to be incubating virulently infectious disease should be detained for a sufficient time to allow the disease to develop; but that, with regard to ships, all that is required is thorough cleansing and fumigation, for in their case time is not esteemed as being by any means an important element whereby we may obtain safety. When vessels arrive at night, except from

proclaimed ports, the custom has been to have them immediately examined, and, unless the passengers are found to be suffering from infectious disease, to give them pratique; but I am by no means convinced that this is a safe course, because of the known difficulty which always attends the diagnosis of mild cases; and, after all, detention until daylight could hardly be considered a very great hardship, while it might prevent an error in diagnosis which would plunge the whole Colony into epidemic sickness.

What was by early Scriptural metaphor so aptly called "the pestilence that walketh in darkness" has from time to time throughout all ages spasmodically engaged the attention of mankind; but curiously enough, this subject, which above all others has most materially affected the happiness of individuals, the prosperity of countries, and even the progress of the civilized world, has for the most part only been seriously considered during the course of some awful epidemic and at its close nations have lapsed into the apathetic state until aroused by another similar calamity. As Hirsch says, "It is human nature to soon forget past sufferings. We bury our dead; a little time will dry our tears; in another little time we dance over their graves."

In early times no effort seems to have been made to trace the epidemics which devastated Europe. The physicians of the 14th century seem not only to have been unable to cope with the terrible mortality of the black death, which swept off in four years one-fourth of the population of the old world, but they seem to have been unable in any way to trace its origin; and the same may be said of the pestilence called the sweating sickness of 1485, the plague of London in 1499, and again the sweating sickness in 1506. But during the previous century the inhabitants of the countries bordering upon the Mediterranean had begun to observe that the Levant was the channel through which these visitations reached them; and reasoning from the experience that communities isolated upon remote islands did not apparently suffer in the same ratio as the more easily accessible populations, they seem to have formed the idea of a quarantine for all vessels arriving from that locality. At first this procedure arbitrarily entailed a detention for forty days, but of late years this has been much modified; the laws of those countries are, however, still very arbitrary in their provisions as regards quarantine, and there is good reason to suspect that commercial jealousies have occasionally stimulated various ports to prostitute the law by proclaiming as infected their more prosperous neighbours, simply in order to injure their commerce and to irritate and annoy their rulers. However, the earnestness and vigour with which those countries still advocate a modification of the old system would seem to show that it must have rendered good service in the past.

The subject of quarantine has been deemed of such vast importance by European nations that during the last thirty-two years no less than thrice have what have been called International Sanitary Conferences been convened to discuss the whole question. The first of these, which was held in Paris in 1851, was very comprehensive in its scope, as it undertook to determine the question of quarantine in respect not only to cholera but also to other infectious diseases, and especially yellow fever and the plague. It must be here noted that small-pox, typhus, and some other infectious diseases were considered endemic in Europe, and therefore were not discussed. There were present both consular and medical delegates from Great Britain, France, Austria, Russia, Spain, Portugal, Greece, Tuscany, Naples, the Papal States, and Turkey. For no less than eight months they continued their deliberations, and amongst them there seemed to be a very great difference of opinion as to the necessity for strict quarantine, especially as regards cholera, the British, French, and Austrian members being opposed to its being rigorously carried out; but it was nevertheless carried by a large majority that a modified quarantine should be maintained. The British did not assent, because the restriction upon the freedom of intercourse was considered unnecessarily harsh, but it is worthy of note that within a few years afterwards the quarantine of some of the countries represented was more rigorous than ever.

The International Conference on the same subject in 1866, which was held at Constantinople, was chiefly on the subject of cholera; it was attended by representatives from Great Britain, France, Austria, Prussia, The Netherlands, Belgium, Denmark, Russia, Spain, Portugal, Greece, Italy, Sweden and Norway, the Papal States, and Egypt. Here the French representatives seem to have taken the initiative, and to have recommended very much more stringent measures than those opposed by them at the Conference of 1851. In fact their proposal would virtually have stopped all trade in the Red Sea, during the prevalence of cholera, among the pilgrims who annually visit Mecca, and who are so liable to its ravages. The English delegate again opposed, on the ground of interference with commerce; but the Swedish representative immediately met him with the argument that the interests of the public health should override all other considerations. The question that the Turkish Government should be recommended to adopt these rigorous measures was decided in the affirmative by a majority of 17 to 8. It was also decided that India, especially the valley of the Ganges, was the source from which the pestilence always rose; that it was transmissible by human intercourse between places was also shown, and the efficacy of restrictive measures was very clearly proved, the several countries which escaped the visitation of 1865 being those where a rigorous

quarantine was maintained. And finally, the fact that bad hygienic and general insanitary conditions predisposed places to virulent epidemics of cholera when once it was imported, was very generally agreed to.

The last great Conference, which was held at Vienna in 1874, was the most scientifically conducted and the most important of all. It was called together by the Government of Austria, and no less than twenty-one Governments sent representatives. Its business was divided into four sections :—1st. Scientific questions relating to cholera and other diseases of epidemic nature. 2nd. Questions as to quarantine. 3rd. Concerning the formation of a permanent International Commission upon Epidemics. 4th. As to yellow fever. The discussion upon cholera occupied so much time that the last section was left out of consideration; but it was unanimously resolved that the first-named disease could be, and was, transmitted not only by persons coming from an infected locality, but by the personal effects of those who have been affected; and it was, by a majority, resolved that it could be produced in a variety of other ways, which I need not now enumerate. The second question was divided into two parts, quarantine by land and quarantine by sea. Land quarantine was by a majority pronounced impracticable; but the Conference expressed its approval of the measures recommended by the previous Conference held at Constantinople, as regards sea quarantine, and especially with reference to the Red and Caspian Seas. However, they provided an alternative measure to be adopted should cholera once again obtain a foothold in Europe; or for those States which preferred a milder course, in a system of medical inspection, and, if necessary, disinfection, without the detention of the apparently healthy. The project for the establishment of a permanent International Commission upon Epidemics was, I am glad to say, unanimously agreed to.

Like cholera, yellow fever has what may be called a permanent home—this is situated in the districts within the Mexican Gulf—and at one time it was believed that it could not exist beyond this unfortunate locality; but we know that within the last five and twenty years it has frequently been carried from thence to new fields for its ravages, and epidemics of awful magnitude have been experienced in latitudes precisely similar to that of this city. It visited Brazil in 1852, the southern portions of Europe in 1870, in 1871 there was a terrible epidemic in Buenos Ayres, and it also occurred in Monte Video, while in 1873 it ravaged the Southern States of America. Clearly all these cases were first imported from the Mexican Gulf, where it is endemic; and that the authorities of the American States are thoroughly alive to this danger is shown by the very rigid inspection of ships they enforce in the Southern States. I must observe, however, the manner in which yellow

fever may be conveyed is a point which has been warmly contested, and by several Commissions decided in as many different ways; but I think that I am right in saying that all agree that it may be conveyed in clothing which has been used by an infected person.

At the International Medical Congress of 1881 the subject of quarantine met with careful consideration, and it is only fair that I should say that on the whole a much modified system seemed to be viewed with most favour—rather a system of inspection and purification than one of detention during the incubatory period. Professor De Chaumont, in a paper there read by him, says:—"With reference to quarantine, as originally understood, I think that we may look upon this as a relic of barbarous times. It is impossible to carry it out strictly and absolutely, and anything less than that only inflicts commercial loss and personal hardships, besides in some cases increasing the danger it seeks to prevent. If vessels are carefully inspected and the sick removed to hospital for treatment, all others who show no signs of illness, as tested by the thermometer, &c., might be allowed to leave, with the precaution that each should be stripped of his clothing and take a general bath. The clothing, in the meantime, should either be disinfected by heat or destroyed, the owners being compensated. Steps should of course be taken to cleanse and fumigate the vessel, and to disinfect everything on board. With proper hygienic measures at home, we need not fear the importation of disease from abroad."

Gentlemen, although I cannot say that we should be prepared to quite accept the last sentence as infallible, yet, nevertheless, I fully recognize what a world of wisdom it contains.

I think that I have said before that the geographical position of England deprives it of the advantages to be derived from a comprehensive quarantine system, yet nevertheless it would seem that serious attention has been more than once given to the circumstance that her great seaports suffer from imported infectious disease to a very considerable extent. I recently perused a paper by Dr. J. Stopford Taylor, of Liverpool, read before the International Medical Congress, the peroration of which states that one of its objects "is to bring before the Congress a brief account of some of the calamities which have been inflicted upon the inhabitants of Liverpool by the importation of infectious disease."

It is hardly necessary to give instances where ships have conveyed epidemic diseases to remote countries; but, were it necessary, the history of the manner in which a United States frigate conveyed cholera to Japan, causing, it is said, 200,000 deaths from that disease in the city of Yeddo alone—or that of the shocking epidemic of measles in Fiji, in which, if I mistake not, 50,000 or more persons are said to have died, and which is said to have been the result of a visit of one of our own ships of war—would suffice.

Hitherto we in the Australian Colonies have enjoyed a remarkable immunity from epidemic sickness, owing, no doubt, chiefly to our geographical position. Situated as we are at a great distance from those countries with which we have had any considerable trade, diseases have had time to develop and die out during the necessarily tedious voyage of vessels carrying passengers to our shores; but now, when in a few weeks rapid mail steamers bridge over the distances which at one time took as many months to traverse, we can hardly hope to obtain protection in this way. And, moreover, our trade with India, China, and the islands of the Eastern Archipelago—countries distant but a couple of weeks' sail—is rapidly developing, and I am afraid that it is from this source that we may one day receive a blow, in the shape of some terrible epidemic, which half a century's prosperity will hardly suffice to repair.

In all the Australian Colonies the quarantine system is authorized; but the thoroughness with which it is enforced varies very much in several, and there is no mutual agreement between them as to what is and what is not necessary for our common weal. All show the same disposition to evade the duty of dealing with infected vessels, and frequently great difficulty is experienced by their owners or agents in obtaining proper accommodation for the sick in consequence. This was very clearly shown in the case of the "Mirzapore" some years ago, when she arrived at Adelaide with one patient suffering from small-pox. He was not allowed to land, but was obliged to go on in the ship, and I have been informed that when the vessel arrived at Melbourne there were half a dozen more persons ill with the same disease. More recently we had the "Menmuir" sent on to us in similar fashion; and there can be no doubt that the subsequent outbreak, in which no less than eight persons were affected, was caused by the unfortunate circumstance that the first patient was not promptly landed on the northern coast. Having these difficulties in view, I a short time since deemed it my duty to draw the attention of our Government to the necessity for an agreement with the neighbouring Colonies upon the subject, and pointed out the propriety of establishing quarantine stations at the northern and western extremities of our coasts, so that vessels approaching the Colonies with infectious disease on board might promptly land the sick; and then, after purification, come on to their destination in quarantine. That this would be an advantage to the passengers of such vessels must be apparent to all, as they would be the sooner rid of a source of danger to themselves; and that it would benefit the vessels is shown by the favour with which the proposal has been received by the Steamship Owners' Association of New South Wales. We should have quarantine regulations common to all the Colonies; and the stations, which would manifestly be for the benefit of all

of them, might be maintained at their joint expense, in the ratio of their respective populations. In short, we should have a federal quarantine for Australia; for whatever differences of opinion may exist amongst our politicians as regards the land policy, or the question of the relative merits of free trade and protection, there certainly can be no difference of opinion as to the necessity for keeping our country pure and free from epidemic disease; and the only question to be decided is whether that is most likely to be accomplished by a federal quarantine.

Discussion.

Dr. Morgan acknowledged the great importance of the subject brought under notice by Dr. Mackellar, but at the same time regretted that he had not described the details of the system of federal quarantine that he proposed, as these formed a most essential matter for them to consider. They were certainly free from five or six of the great epidemic diseases, and their immunity arose from nature having hitherto provided them with a quarantine in the shape of a three months' voyage. The duration of this voyage had now been considerably shortened, and it became a more imperative duty for them to take measures for preventing the introduction of disease here.

Dr. Belgrave expressed a conviction that there existed urgent necessity for the establishment of some federal system of quarantine which would be equally binding on every Australian State. He instanced one case in practical proof of this necessity, which he thought was almost unique in epidemiological records. It appears that about ten years ago the speaker arrived in a new and well appointed and well commanded ship, the "Hesperus," belonging to Anderson & Co. (now of the Orient line), and chartered by the Government of South Australia for the conveyance to Adelaide of about 500 emigrants. About a week after the ship left Plymouth, one severe case of measles occurred in a young man; and the disease subsequently attacked all the young and many of the adults on board, about 200 in all. On arriving off Adelaide, the circumstance was communicated to the then Health Officer, Dr. Duncan, a gentleman who stood deservedly high in both colonial and professional estimation. After consideration, the Health Officer stated that, as there existed no quarantine station either at Kangaroo Island or any other convenient spot, nor any floating structure used for the purpose, he did not see that any beneficial purpose could be served by denying pratique. The result of this absence of any place for the temporary isolation and disinfection of passengers was that the disease immediately gained a footing in Adelaide, and extended with such rapidity overland that it reached the important inland Victorian cities Sandhurst and Victoria,

thence reaching Sydney, from where it was carried to Melbourne and Fiji, ultimately reaching New Zealand and nearly every island in Oceanica, destroying in its course—according to some statisticians who investigated the subject—no less than 100,000 people. Dr. Belgrave said that if the examinations at the Plymouth Depôt, or the inquiries through the Agent-General, had been anything but the absolute farce they were, the fact of the boy (the first case) having left a house notorious in its neighbourhood as having been saturated with the poison of measles, would have been made known to the emigration officers, and a series of calamitous outbreaks throughout Australasia would have been prevented. Dr. Duncan, the Adelaide Health Officer, said they had had no measles in their Colony for fourteen years before the arrival of the "Hesperus"; and he (the speaker) had elicited that during the *seven* previous years there had been none in Sydney, though this identical epidemic had reached a week or two before his arrival, having reached it within about two months of the arrival of the "Hesperus" at Adelaide. Dr. Belgrave added that, in his interviews with the South Australian authorities, he had noticed that enlightened views prevailed in those circles; and much regret was felt that no quarantine station existed at Kangaroo Island,—a spot they all appeared to consider particularly suitable for such a purpose.

Dr. THOMAS EVANS thought that the Section was indebted to Dr. Mackellar for setting forth the broad grounds on which a federal quarantine was necessary, rather than occupying its time with details.

The profession was never so united in the Colonies as at present, or in such a position to speak with authority; the attention of the public was awakened to the importance of these questions of public health, and it was high time Ministers should cease to rely on men, not professional, who raked up musty opinions from volumes long since out of date. We need legislation not in the direction of the principle of quarantine only, but, more than stringent acts, we needed men to carry them out who are up to the scientific work of the present day, men of broad understanding and self-reliance, prepared to act for themselves on an emergency, for no rules could be prepared to meet every necessity; and that these men should be unfettered by the petty jealousies existing between different departments, but responsible only to one head, who in turn would be answerable to the representatives of the people. In other words, the importance of this and kindred questions demanded the appointment of a Minister of Public Health, with a department under his sole control.

Dr. EWAN said that this was a matter which demanded earnest attention; and while he entirely agreed with the remarks which had been uttered by Dr. Mackellar during the reading of his

admirable paper, he would specially direct attention to the necessity which existed for a thorough medical examination of emigrant ships at the port of embarkation, and to the necessity for a rigid enforcement of certain hygienic rules during their voyage to this Colony, as he believed that by such means the danger of infection from England would be reduced to a minimum. It was, however, more particularly in ships hailing from the East that disease would be likely to be brought, and at any moment epidemic cholera, which was now causing such havoc in some of the Eastern cities, might be landed in our midst. Cholera might reach us by one of two routes, leaving China or Japan, and coming down the Queensland coast, or taking its rise in the towns bordering on the Red Sea or Suez Canal, it might creep round the western coasts of our continent and spread throughout these Colonies. We must be prepared to establish two Federal Quarantine Stations: one on an island adjacent to the north-eastern portion of Queensland, and a second in the neighbourhood of Western Australia. He felt certain that the members of the Section would heartily indorse the action proposed by Dr. Mackellar, as by such means only was it possible to cope successfully with infectious diseases invading these Colonies from foreign ports.

Dr. MacLaurin had listened with great pleasure to Dr. Mackellar's able address on Federal Quarantine, with every word of which he heartily agreed.

The objections which had recently been brought against the quarantine system appeared to be twofold: first, that quarantine was useless, *i.e.*, that it did not give the necessary protection against the spread of disease; secondly, that it was unnecessary, or in other words that equally good results could be obtained from less irksome means of prevention.

As to the first of these objections, it must be borne in mind that quarantine had, as a matter of fact, only been strictly carried out with respect to two diseases, viz., small-pox in Australia, and the oriental plague in Europe. How completely successful quarantine had been with respect to small-pox in Australia it was unnecessary to state, as every one present was well acquainted with the facts. That it had been equally successful in the other case was evident from the most cursory study of history.

After the Turkish naval power had been broken by the battle of Lepanto, the sea-borne traffic between the west of Europe and the Levant increased enormously, and, as a consequence, within less than thirty years the plague was to be found occasionally raging with great severity, but always present sporadically in almost every city of any consequence in the west. How severely it was felt in London every one knows, but even in a comparatively remote port like Leith half the population are said to have died in one year (1645) from this cause.

General terror being spread in this way throughout the whole of Europe, the most rigid measures for separation by quarantine were gradually adopted by all countries, both with respect to home and to foreign communication; and although in no case were the means of segregation so complete as exist in Sydney, yet from the great number of, as it were, successive filters interposed in the track of the disease its progress was at length checked, and by the last quarter of the eighteenth century it had practically ceased to exist in the west. For forty years it was kept at bay, till by an accidental oversight it was allowed to reach Marseilles in 1720, where it raged for nearly two years with extreme severity. Since that date the plague has been practically an unknown disease in the west, but the measures taken to prevent its spread by the countries on the seaboard of the Mediterranean are still of a very stringent character.

As for the second objection, there could be no doubt that great good would result from careful inspection of crews and passengers, and from isolation of the sick from the healthy. But this measure would entirely fail to meet the case of disease in the incubation period. This in small-pox would extend to about thirteen days after exposure to infection. During this time it would be quite impossible to tell whether or not a person who had been exposed to infection has really taken the complaint; and therefore, the only means of insuring perfect immunity for our community was to prevent persons who arrived in a small-pox ship from mixing with the land population till the lapse of time had demonstrated the impossibility of their communicating the disorder. This could only be attained by a rigorous system of quarantine. The results of neglecting this precaution were to be seen in the recent lamentable epidemic at the Cape of Good Hope.

It had been objected to Dr. Mackellar's paper that he had given no account of the detailed steps which would have to be taken to establish a Federal Quarantine. This objection seemed to have no weight. The details of federation in the quarantine establishment were matters to be settled by the officers of the various Colonial Governments assembled in conference for the purpose. What the Section ought to do was to affirm the principle laid down by Dr. Mackellar: the details would be matter for further consideration.

The speaker again expressed his entire concurrence with everything stated by Dr. Mackellar in his paper.

Sir Alfred Roberts said that the Section was greatly indebted to Dr. Mackellar for the interesting and important paper just read. The question raised in it was of as much importance to the people of every one of the Australian Colonies as to the inhabitants of New South Wales.

The geographical position of Australia had its peculiarities and drawbacks, but it possessed this great advantage,—they could reduce the chances of importation of infectious disease to a minimum by efficient quarantine arrangements, but these could not be made or carried out in such a manner as to insure the full degree of immunity, except by the hearty and unanimous co-operation of all the Australian Colonies.

He did not think it would be wise to enter just now into a discussion upon the details of the question,—these should be initiated by and dealt with by the Conference which he hoped soon would be appointed. The matter should be considered in all its bearings, with deliberation and impartiality.

The rules of the Section prevented his proposing any appeal or recommendation to the Government; he would therefore simply move, "That this meeting is of opinion that Federal Quarantine is necessary, in the interests of the health of the Australian Colonies." He had no doubt but that an expression of its views on the part of this meeting would reach the Government, and have a beneficial influence upon its deliberations on a subject such as that of Quarantine.

Dr. Beattie seconded the motion, which was carried unanimously.

APPENDIX.

ABSTRACT OF THE METEOROLOGICAL OBSERVATIONS TAKEN AT THE SYDNEY OBSERVATORY.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

JANUARY, 1883.—General Abstract.

Barometer	Highest Reading	30·128 inches on the 3rd, at 10 a.m.
At 32° Faht., but not corrected to sea-level.	Lowest Reading	29·515 „ on the 24th, at 3 p.m.
	Mean Height	29·806

(Being 0·040 greater than that in the same month on an average of the preceding 24 years.

Wind	Greatest Pressure ...	12·5 lbs. on the 21st.
	Mean Pressure	0·9 lb.
	Number of Days Calm ...	1
	Prevailing Direction ...	S.

(Prevailing direction during the same month for the preceding 24 years, E.N.E.)

Temperature	Highest in the Shade ...	81·9 on the 1st.
	Lowest in the Shade ...	59·7 on the 24th.
	Greatest Range	19·5 on the 1st.
	Highest in the Sun ...	145·6 on the 23rd.
	Lowest on the Grass ...	48·2 on the 2nd.
	Mean Diurnal Range ...	12·4
	Mean in the Shade ...	70·3

(Being 1·0 less than that of the same month on an average of the preceding 24 years.)

Humidity ...	Greatest Amount ...	99·0 on the 18th.
	Least	44·0 on the 1st.
	Mean	77·1

(Being 4·6 less than that of the same month on an average of the preceding 24 years.)

Rain	Number of Days	18 rain and 1 dew.
	Greatest Fall	2·242 inches on the 28th.
	Total Fall...	8·443 „ 65 feet above ground. 10·489 „ 15 in. above ground.

(Being 7·130 inches greater than that of the same month on an average of the preceding 24 years.

Evaporation	Total Amount	3·524 inches.
Electricity ...	Number of Days Lightning	6
Cloudy Sky ...	Mean Amount	6·6
	Number of Clear Days ...	1
Meteors ...	Number observed ...	0

Remarks.

The temperature has been low this month,—the highest in the shade being only 81·9, and the mean 1° less than the average. The rainfall has been almost entirely confined to the coast districts, in many parts of which the fall has been very heavy. At Antony, Tweed River, 20·82 inches fell; at Sydney, 10·49; the northern part of Liverpool Plains also had some rain, but the rest of the Colony had very little, if any. The remarkable quantity at Antony is no doubt a result of the very high hills near, but even at Clarence River Heads 18·09 inches fell.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

FEBRUARY, 1883.—GENERAL ABSTRACT.

Barometer ...	Highest Reading	29·999 inches on the 15th, at 8 a.m.
At 32° Faht., but not corrected to sea-level.		
	Lowest Reading	29·232 „ on the 18th, at 3 p.m.
	Mean Height	29·660

(Being 0·015 less than that in the same month on an average of the preceding 24 years.)

Wind	Greatest Pressure ...	27·4 lbs. on the 28th.
	Mean Pressure	1·0 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	E.N.E.

(Prevailing direction during the same month for the preceding 24 years, S.)

Temperature	Highest in the Shade ...	84·9 on the 28th.
	Lowest in the Shade ...	57·8 on the 23rd.
	Greatest Range	20·3 on the 8th.
	Highest in the Sun ...	147·0 on the 11th.
	Lowest on the Grass ...	51·1 on the 8th.
	Mean Diurnal Range ...	111·8
	Mean in the Shade ...	70·2

(Being 0·6 less than that of the same month on an average of the preceding 24 years.)

Humidity ...	Greatest Amount ...	96·0 on the 2nd at 9 p.m.
	Least	42·0 on the 28th at 9 p.m.
	Mean	73·7

(Being 1·0 less than that of the same month on an average of the preceding 24 years.

Rain	Number of Days	14 rain and 6 dew.
	Greatest Fall	2·670 inches on the 3rd.
	Total Fall... ...	4·073 „ 65 ft. above ground.
		5·965 „ 15 in. above ground.

(Being 0·152 inches less than that of the same month on an average of the preceding 24 years.)

Evaporation	Total Amount	3·199 inches.
Electricity ...	Number of Days Lightning	4
Cloudy Sky ...	Mean Amount	6·7
	Number of Clear Days ...	1
Meteors ...	Number observed ...	0

Remarks.

The temperature, barometer, and rain, have all been very near the average for this month. On the 3rd very heavy rain (2·670) fell at Sydney. In the country districts generally the rainfall has been abundant, the exception being the S.W. districts. Seventy-four stations have had more than 3 inches, many 7 to 8 inches; Springfield, Wollongong, 12·95 inches. A remarkable difference in what may be called the city rainfall appears this month. At Sydney the total is 5·97; Croydon, 8·70; Botany, 9·13; Crown-street Reservoir, 5·81; and Randwick, 6·25; and a comparison of the records shows that the greater part of the difference was in the rain of February 3rd, when only 2·67 fell at Sydney, 5·00 at Botany, and 5·17 at Croydon.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10ʰ 4ᵐ 50·81ˢ; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

MARCH, 1883.—GENERAL ABSTRACT.

Barometer ...	Highest Reading... ...	30·156 inches on the 24th, at 9 a.m.
At 32° Fsht., but not corrected to sea-level.		
	Lowest Reading	29·484 „ on the 10th, at 4 p.m.
	Mean Height	29·948

(Being 0·061 greater than that in the same month on an average of the preceding 24 years.

Wind... ...	Greatest Pressure ...	6·5 lbs. on the 2nd and 9th.
	Mean Pressure	0·4 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	E.N.E.

(Prevailing direction during the same month for the preceding 24 years, N.E.)

Temperature	Highest in the Shade ...	78·3 on the 13th.
	Lowest in the Shade ...	55·2 on the 3rd.
	Greatest Range	21·5 on the 13th.
	Highest in the Sun ...	137·7 on the 5th.
	Lowest on the Grass ...	49·5 on the 13th.
	Mean Diurnal Range ...	13·7
	Mean in the Shade ...	67·9

(Being 1·5 greater than that of the same month on an average of the preceding 24 years.

Humidity ...	Greatest Amount ...	93·0 on the 22nd, at 9 a.m.
	Least	47·0 on the 11th, at 9 a.m.
	Mean	71·1

(Being 5·5 less than that of the same month on an average of the preceding 24 years.

Rain	Number of Days	8 rain and 4 dew.
	Greatest Fall	0·790 inches on the 3rd.
	Total Fall...	0·971 „ 65 feet above ground.
		1·449 „ 15 in. above ground.

(Being 3·679 inches less than that of the same month on an average of the preceding 24 years.

Evaporation	Total Amount	2·867 inches.
Electricity ...	Number of Days Lightning	4
Cloudy Sky ...	Mean Amount	4·7
	Number of Clear Days ...	3
Meteors ...	Number observed ...	0

Remarks.

This month has been fine and rather dry, the temperature being 1·5 greater than the average, and the rainfall 3·679 below the average. It will be seen from the record from the country stations that the rainfall for the month has not been heavy anywhere, and that, while very many of the stations have had from 1 to 2 inches, there are others which record a rainfall far below what might be expected for March. In part of the Darling country it has been very dry.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

APRIL, 1883.—GENERAL ABSTRACT.

Barometer ... Highest Reading... ... 30·283 inches on the 14th, at 10 a.m.
At 32° Faht., but not corrected to sea-level.
Lowest Reading... ... 29·575 „ on the 9th, at 2 p.m.
Mean Height ... ... 29·959.

(Being 0·031 greater than that in the same month on an average of the preceding 24 years.)

Wind... ... Greatest Pressure ... 14·0 lbs. on the 9th.
Mean Pressure ... ... 0·4 lb.
Number of Days Calm ... 1
Prevailing Direction ... W.

(Prevailing direction during the same month for the preceding 24 years, W.)

Temperature Highest in the Shade ... 77·3 on the 4th.
Lowest in the Shade ... 53·1 on the 19th.
Greatest Range ... ... 19·9 on the 19th.
Highest in the Sun ... 126·5 on the 2nd.
Lowest on the Grass ... 47·4 on the 8th and 19th.
Mean Diurnal Range ... 13·0
Mean in the Shade ... 63·6

(Being 1·3 less than that of the same month on an average of the preceding 24 years.)

Humidity ... Greatest Amount ... 97·0 on the 23rd, 24th, and 30th.
Least ... ... 41·0 on the 9th.
Mean ... ... 79·9

(Being 2·5 greater than that of the same month on an average of the preceding 24 years.)

Rain ... ... Number of Days... ... 15 rain and 10 dew.
Greatest Fall ... ... 1·260 inches on the 25th.
Total Fall ... ... { 3·102 „ 65 feet above ground. 3·958 „ 15 in. above ground. }

(Being 2·767 inches less than that of the same month on an average of the preceding 24 years.)

Evaporation Total Amount ... ... 2·013 inches.

Electricity ... Number of Days Lightning 6

Cloudy Sky ... Mean Amount ... ... 5·1
Number of Clear Days ... 2

Meteors ... Number observed ... 4

Remarks.

This month has been cool, temperature being 1·3 less than the average in Sydney. On the coast there has been moderate rains, but much less than the average for this month. On the high lands the condition as to rainfall has been similar, but in the south-western districts the extremely dry weather continues, and is causing serious losses.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

MAY, 1883.—GENERAL ABSTRACT.

Barometer ...	Highest Reading... ...	30·206 inches on the 9th at 8 a.m.
At 32° Faht., but not corrected to sea-level.		
	Lowest Reading	29·460 „ on the 15th at 2 p.m.
	Mean Height	29·852

(Being 0·055 less than that in the same month on an average of the preceding 24 years.)

Wind	Greatest Pressure ...	13·5 lbs. on the 9th.
	Mean Pressure	0·8 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	W.

(Prevailing direction during the same month for the preceding 24 years, W.)

Temperature	Highest in the Shade ...	72·2 on the 4th.
	Lowest in the Shade ...	45·6 on the 31st.
	Greatest Range	16·1 on the 4th.
	Highest in the Sun ...	119·5 on the 6th.
	Lowest on the Grass ...	38·9 on the 28th.
	Mean Diurnal Range ...	11·0
	Mean in the Shade ...	58·8

(Being 0·3 greater than that of the same month on an average of the preceding 24 years.)

Humidity ...	Greatest Amount ...	100·0 on the 5th and 31st.
	Least	49·0 on the 28th.
	Mean	77·5

(Being 1·6 greater than that of the same month on an average of the preceding 24 years.)

Rain	Number of Days... ...	21 rain and 9 dew.
	Greatest Fall	1·414 inches on the 11th.
	Total Fall... ...	4·155 „ 65 ft. above ground.
		5·997 „ 15 in. above ground.

(Being 0·997 inches greater than that of the same month on an average of the preceding 24 years.)

Evaporation	Total Amount	1·831 inches.
Electricity ...	Number of Days Lightning	11
Cloudy Sky ...	Mean Amount	6·7
	Number of Clear Days ...	2
Meteors ...	Number observed ...	1

Remarks.

The rainfall has been generally abundant this month. On the coast the greatest amount (15 inches) fell at Cape George. On the western slopes the fall has been about 2 inches, rising at some places, as at Orange, to 4·41 inches.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10ʰ 4ᵐ 50·81ˢ; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

JUNE, 1883.—GENERAL ABSTRACT.

Barometer ... At 32° Faht., but not corrected to sea-level.	Highest Reading... ...	30·347 inches on the 12th, at 10 a.m.
	Lowest Reading	29·474 „ on the 22nd, at 3 a.m.
	Mean Height	29·996

(Being 0·078 greater than that in the same month on an average of the preceding 24 years.)

Wind	Greatest Pressure ...	12·5 lbs. on the 23rd.
	Mean Pressure	0·3 lb.
	Number of Days Calm ...	11
	Prevailing Direction ...	W.

(Prevailing direction during the same month for the preceding 24 years, W.

Temperature	Highest in the Shade ...	71·9 on the 16th.
	Lowest in the Shade ...	42·8 on the 29th.
	Greatest Range	22·2 on the 16th.
	Highest in the Sun ...	119·9 on the 16th.
	Lowest on the Grass ...	34·4 on the 26th.
	Mean Diurnal Range ...	14·7
	Mean in the Shade ...	54·6

(Being 0·3 greater than that of the same month on an average of the preceding 24 years.

Humidity ...	Greatest Amount... ...	97·0 on the 9th and 12th.
	Least	43·0 on the 29th.
	Mean	75·1

(Being 1·5 less than that of the same month on an average of the preceding 24 years

Rain	Number of Days... ...	4 rain and 16 dew.
	Greatest Fall	0·680 inches on the 6th.
	Total Fall	0·420 „ 65 feet above ground.
		0·831 „ 15 in. above ground.

(Being 4·487 inches less than that of the same month on an average of the preceding 24 years.)

Evaporation	Total Amount	1·217 inches.
Electricity ...	Number of Days Lightning	2
Cloudy Sky ...	Mean Amount	3·9
	Number of Clear Days ...	8
Meteors ...	Number observed ...	1

Remarks.

June has been a very dry month over the greater part of the Colony, the total rain measuring in these places less than 1 inch; the southern districts, however, west of the main range, have had from 1 to 3 inches, the heaviest, excepting of course Kiandra, 3·11 inches at Albury.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

JULY, 1883.—GENERAL ABSTRACT.

Barometer ... At 32° Faht., but not corrected to sea-level.	Highest Reading	30·297 inches on the 30th, at 10 a.m.
	Lowest Reading	29·421 „ on the 27th, at 12 a.m.
	Mean Height	29·952

(Being 0·010 inch greater than that in the same month on an average of the preceding 24 years.)

Wind	Greatest Pressure ...	19·8 lbs. on the 9th.
	Mean Pressure	0·8 lb.
	Number of Days Calm ...	4
	Prevailing Direction ...	W.

(Prevailing direction during the same month for the preceding 24 years, W.

Temperature	Highest in the Shade ...	65·2 on the 16th.
	Lowest in the Shade ...	39·7 on the 18th.
	Greatest Range	21·5 on the 16th.
	Highest in the Sun ...	109·2 on the 8th.
	Lowest on the Grass ...	33·3 on the 18th.
	Mean Diurnal Range ...	13·6
	Mean in the Shade ...	52·2

(Being 0·1 less than that of the same month on an average of the preceding 24 years.

Humidity ...	Greatest Amount ...	99·0 on the 31st.
	Least	40·0 on the 26th.
	Mean	72·8

(Being 2·2 less than that of the same month on an average of the preceding 24 years.)

Rain	Number of Days... ...	12 rain and 2 dew.
	Greatest Fall	1·118 inches on the 23rd.
	Total Fall... ...	2·119 „ 65 ft. above ground.
		2·833 „ 15 in. above ground.

(Being 1·207 inches less than that of the same month on an average of the preceding 24 years.)

Evaporation	Total Amount	1·641 inches.
Electricity ...	Number of Days Lightning	0
Cloudy Sky ...	Mean Amount	3·8
	Number of Clear Days ...	6
Meteors ...	Number observed ...	0

Remarks.

Barometric pressure has been 0·010 greater than the average for this month, and the temperature slightly (0·1) less. In Sydney the rainfall was 1·207 less than the average, and over nearly the whole of the Colony the weather has been very dry during July; the exceptions are as usual the coast districts and part of the southern districts—that lying south of Forbes. In the north there has been very little rain—in many places not a drop.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, $10^h\ 4^m\ 50{\cdot}81^s$; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

AUGUST, 1883.—GENERAL ABSTRACT.

Barometer ...	Highest Reading... ...	30·270 inches on the 1st, at 10 a.m.
At 32° Faht., but not corrected to sea-level.		
	Lowest Reading	29·483 „ on the 31st, at 3 a.m.
	Mean Height	29·930

(Being 0·006 inch less than that in the same month on an average of the preceding 24 years.)

Wind... ...	Greatest Pressure ...	13·5 lbs. on the 12th.
	Mean Pressure	0·4 lb.
	Number of Days Calm ...	4
	Prevailing Direction ...	W.

(Prevailing direction during the same month for the preceding 24 years, W.)

Temperature	Highest in the Shade ...	80·9 on the 19th.
	Lowest in the Shade ...	53·1 on the 22nd.
	Greatest Range	26·3 on the 18th.
	Highest in the Sun ...	127·8 on the 19th.
	Lowest on the Grass ...	33·9 on the 6th.
	Mean Diurnal Range ...	16·5
	Mean in the Shade ...	55·8

(Being 0·9 greater than that of the same month on an average of the preceding 24 years.)

Humidity ...	Greatest Amount ...	100·0 on the 9th.
	Least	36·0 on the 18th.
	Mean	72·2

(Being exactly to that of the same month on an average of the preceding 24 years.)

Rain	Number of Days	11 rain and 4 dew.
	Greatest Fall	1·132 inches on the 21st.
	Total Fall...	2·389 „ 65 ft. above ground.
		2·821 „ 15 in. above ground.

(Being 0·223 inch less than that of the same month on an average of the preceding 24 years.)

Evaporation	Total Amount	1·754 inches.
Electricity ...	Number of Days Lightning	2
Cloudy Sky ...	Mean Amount	4·9
	Number of Clear Days ...	3
Meteors ...	Number observed ...	0

Remarks.

This month the barometer has been very close to the average, and the temperature 0·9 above the average. The baragraph recorded some remarkable waves: the first began 5 p.m., August 27th, and was at its maximum about 6 p.m.; the second at 7·30 p.m. on 28th; and the third at 5 a.m. on the 29th. The rainfall this month has been light generally, and in some places so little as to be almost useless for the purposes of vegetation. At others heavy rain has fallen. The heaviest record on the coast is 7·53 at Nelson's Bay; and inland, 3·36 at Orange.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51' 41"; LONGITUDE 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35' 37" East.
Height above Mean Sea-level, 146 feet.

SEPTEMBER, 1883.—GENERAL ABSTRACT.

Barometer ...	Highest Reading	30·247 on the 30th, at 10 a.m.
At 32° Faht., but not corrected to sea-level.		
	Lowest Reading	29·259 on the 3rd, at 2 p.m.
	Mean Height	29·866

(Being 0·010 less than that in the same month on an average of the preceding 24 years.)

Wind	Greatest Pressure ...	12·0 lbs. on the 4th.
	Mean Pressure	0·9 lb.
	Number of Days Calm ...	1
	Prevailing Direction ...	S.

(Prevailing direction during the same month for the preceding 24 years, W.

Temperature	Highest in the Shade ...	82·9 on the 23rd.
	Lowest in the Shade ...	41·2 on the 7th.
	Greatest Range	30·4 on the 23rd.
	Highest in the Sun ...	134·8 on the 23rd.
	Lowest on the Grass ...	33·4 on the 7th.
	Mean Diurnal Range ...	14·5
	Mean in the Shade ...	56·8

(Being 2·0 less than that of the same month on an average of the preceding 24 years.)

Humidity ...	Greatest Amount ...	100·0 on the 27th.
	Least	36·0 on the 4th.
	Mean	71·7

(Being 1·6 greater than that of the same month on an average of the preceding 24 years.)

Rain	Number of Days	15 rain and 1 dew.
	Greatest Fall	4·338 inches on the 28th.
	Total Fall...	4·052 „ 65 ft. above ground.
		6·197 „ 15 in. above ground.

(Being 2·889 inches greater than that of the same month on an average of the preceding 24 years.)

Evaporation	Total Amount	2·229 inches.
Electricity ...	Number of Days Lightning	3
Cloudy Sky ...	Mean Amount	5·0
	Number of Clear Days ...	4
Meteors ...	Number observed ...	0

Remarks.

Over greater part of the colony little or no rain fell this month, but there was a moderate fall on the coast and high lands; it was heaviest in the valley of the Hunter River, and thence towards Sydney. In Sydney the fall was 2·889 greater than the average.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

OCTOBER, 1883.—GENERAL ABSTRACT.

Barometer ...	Highest Reading... ...	30·232 on the 1st, at 9 a.m.
At 32° Faht., but not corrected to sea-level.		
	Lowest Reading	29·273 on the 27th, at 3 p.m.
	Mean Height	29·856

(Being 0·026 greater than that in the same month on an average of the preceding 24 years.)

Wind	Greatest Pressure ...	10·1 lbs. on the 21st.
	Mean Pressure	0·6 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	E.N.E.

(Prevailing direction during the same month for the preceding 24 years, N.E.)

Temperature	Highest in the Shade ...	84·8 on the 17th.
	Lowest in the Shade ...	46·2 on the 1st.
	Greatest Range	22·9 on the 31st.
	Highest in the Sun ...	145·9 on the 17th.
	Lowest on the Grass ...	37·0 on the 1st.
	Mean Diurnal Range ...	13·0
	Mean in the Shade ...	62·1

(Being 1·2 less than that of the same month on an average of the preceding 24 years.)

Humidity ...	Greatest Amount... ...	99·0 on the 20th.
	Least	28·0 on the 17th.
	Mean	69·5

(Being 0·4 greater than that of the same month on an average of the preceding 24 years.)

Rain	Number of Days	15
	Greatest Fall	0·493 inches on the 7th.
	Total Fall...	0·974 „ 65 ft. above ground. 1·808 „ 15 in. above ground.

(Being 1·384 inches less than that of the same month on an average of the preceding 24 years.)

Evaporation	Total Amount	2·674 inches.
Electricity ...	Number of Days Lightning	3
Cloudy Sky ...	Mean Amount	6·1
	Number of Clear Days ...	1
Meteors ...	Number observed ...	0

Remarks.

In Sydney the rainfall was 1·34 less than the average, still the rain was general, if somewhat patchy; some of the western stations having heavy rain, and others light rain.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 50·81s; MAGNETIC VARIATION, 9° 35′ 37″ East.
Height above Mean Sea-level, 146 feet.

NOVEMBER, 1883.—GENERAL ABSTRACT.

Barometer ... Highest Reading ... ... 30·156 on the 23rd, at 1 p.m.
At 32° Faht., but not corrected to sea-level.
Lowest Reading ... ... 29·160 on the 11th, at 4 p.m.
Mean Height ... ... 29·842

(Being 0·044 inch greater than that in the same month on an average of the preceding 24 years.)

Wind ... ... Greatest Pressure ... 8·4 lbs. on the 1st, 2nd, 11th, and 12th.
Mean Pressure ... ... 0·8 lb.
Number of Days Calm ... 1
Prevailing Direction ... S.

(Prevailing direction during the same month for the preceding 24 years, S)

Temperature Highest in the Shade ... 81·1 on the 7th, 14th, and 28th.
Lowest in the Shade ... 50·6 on the 1st.
Greatest Range ... ... 20·8 on the 13th.
Highest in the Sun ... 152·0 on the 14th.
Lowest on the Grass ... 40·2 on the 16th.
Mean Diurnal Range ... 14·4
Mean in the Shade ... 64·4

(Being 2·2 less than that of the same month on an average of the preceding 24 years.)

Humidity ... Greatest Amount ... 92·0 on the 11th.
Least ... ... 32·0 on the 14th.
Mean ... ... 68·4

(Being 1·5 less than that of the same month on an average of the preceding 24 years.)

Rain ... ... Number of Days... ... 13
Greatest Fall ... ... 1·570 inches on the 29th.
Total Fall... ... ... { 1·919 „ 65 ft. above ground.
2·504 „ 15 in. above ground. }

(Being 0·723 inch less than that of the same month on an average of the preceding 24 years.)

Evaporation Total Amount ... ... 3·848 inches
Electricity ... Number of Days Lightning 3
Cloudy Sky ... Mean Amount ... ... 5·1
Number of Clear Days ... 0
Meteors ... Number observed ... 1

Remarks.

This month has been very dry, generally; in Sydney the rainfall was 0·72 below the average, and the temperature 2·2 less than the average; the season so far being remarkably cool.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10^h 4^m $50·81^s$; MAGNETIC VARIATION, 9° 35′ 37″ E
Height above Mean Sea-level, 146 feet.

DECEMBER, 1883.—GENERAL ABSTRACT.

Barometer ... At 32° Faht., but not corrected to sea-level.	Highest Reading... ...	30·092 on the 1st, at 8 p.m.
	Lowest Reading	29·072 on the 12th, at 8 a.m.
	Mean Height	29·677

(Being 0·084 inch less than that in the same month on an average of the preceding 24 y

Wind	Greatest Pressure ...	14·6 lbs. on the 22nd.
	Mean Pressure	0·7 lb.
	Number of Days Calm ...	1
	Prevailing Direction ...	E.N.E.

(Prevailing direction during the same month for the preceding 24 years, N.E.)

Temperature	Highest in the Shade ...	99·6 on the 12th.
	Lowest in the Shade ...	56·1 on the 25th.
	Greatest Range	31·3 on the 20th.
	Highest in the Sun ...	153·6 on the 12th.
	Lowest on the Grass ...	48·4 on the 16th.
	Mean Diurnal Range ...	16·7
	Mean in the Shade ...	70·8

(Being 1·2 greater than that of the same month on an average of the preceding 24 years

Humidity ...	Greatest Amount ...	92·0 on the 27th.
	Least	25·0 on the 20th.
	Mean	63·2

(Being 6·5 less than that of the same month on an average of the preceding 24 years.)

Rain	Number of Days... ...	11 rain and 2 dew.
	Greatest Fall	0·808 inches on the 25th.
	Total Fall...	1·450 „ 65 ft. above ground
		2·069 „ 15 in. above ground

(Being 0·128 inch less than that of the same month on an average of the preceding 24 years

Evaporation	Total Amount	5·179 inches.
Electricity ...	Number of Days Lightning	4
Cloudy Sky ...	Mean Amount	5·2
	Number of Clear Days ...	5
Meteors ...	Number observed ...	0

Remarks.

Taken as a whole the rainfall of 1883 has been very short; this is very striking the returns from places west of the dividing range, where the rainfall in many pla is from 30 to 50 per cent. below the average. Out of 231 stations fifty-five had n a drop of rain this month; of those which had rain ninety-seven had less than h an inch, a quantity which is of no use in such dry weather: the 152 stations rep sent the whole of the western districts. Strong hot winds increased the evaporati and intensified the drought.

LIST OF PUBLICATIONS.

TRANSACTIONS OF THE PHILOSOPHICAL SOCIETY OF NEW SOUTH WALES, 1862-1865.

CONTENTS.

TRANSACTIONS OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1867.

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TRANSACTIONS AND PROCEEDINGS OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1875.

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(Edited by Professor Liversidge.)

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1876.

Vol. X.

CONTENTS.

(Edited by Professor Liversidge.)

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1877.

Vol. XI.

CONTENTS.

(Edited by Professor Liversidge.)

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1878.

Vol. XII.

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(Edited by Prof. Liversidge and Dr. Leibius.)

PAPERS READ BEFORE THE SECTIONS.

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1879.

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CONTENTS.

(Edited by Prof. Liversidge.)

Papers read before the Sections.

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES. 1880.

Vol. XIV.

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(Edited by Prof. Liversidge.)

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1881.

Vol. XV.

CONTENTS.

(Edited by Prof. Liversidge, F.R.S.)

Papers read before the Sections.

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1882.

Vol. XVI.

Contents.

(Edited by Prof. Liversidge, F.R.S.).

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1883.

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